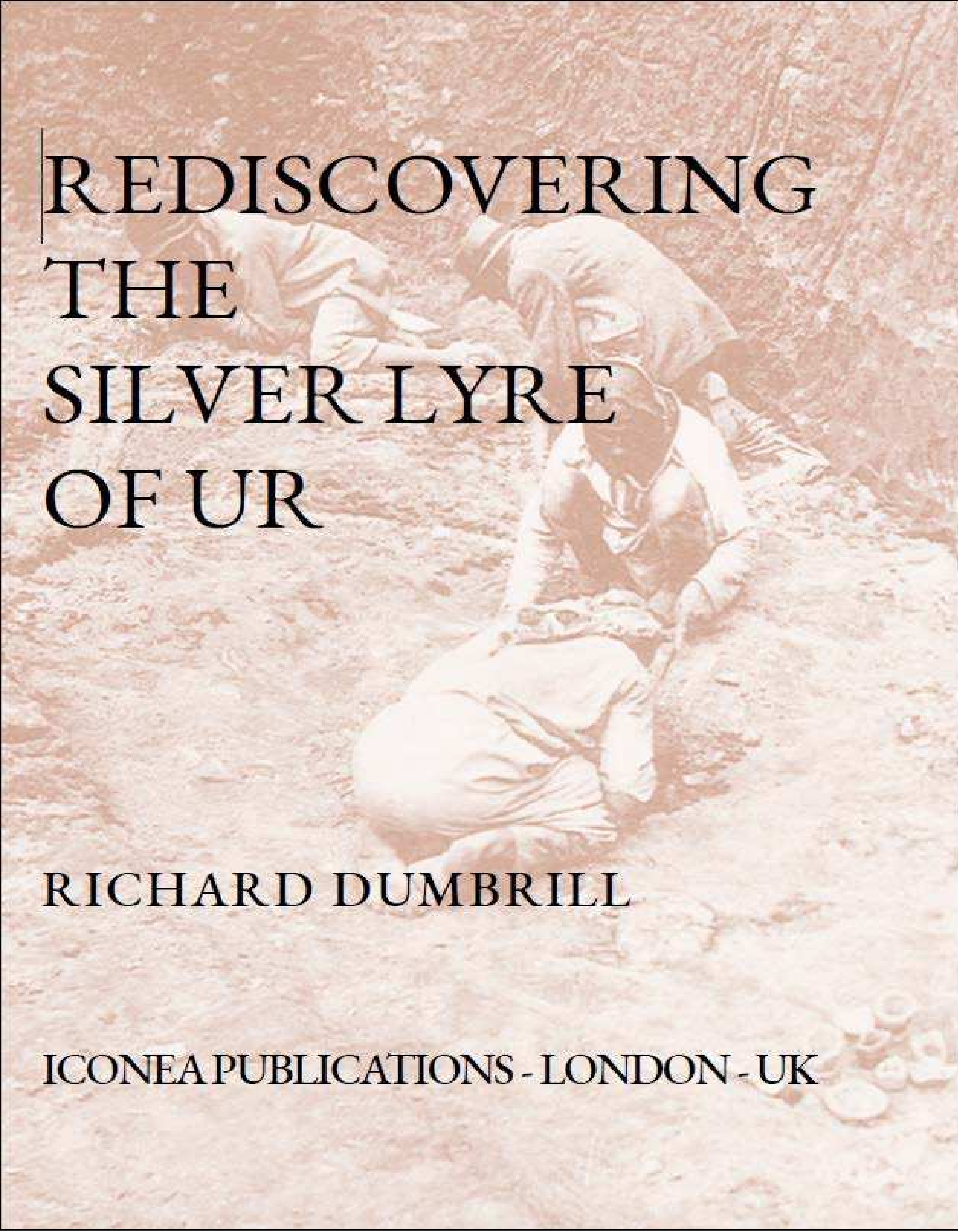


REDISCOVERING THE SILVER LYRE OF UR

RICHARD DUMBRILL

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REDISCOVERING THE SILVER LYRE OF UR

BRITISH MUSEUM 121199



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With contributions of Myriam Marcetteau

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Acknowledgements

It is sincerely that I would like, generally, to thank the staff of the Near East Department of the British Museum for their help throughout the writting of this book, and particularly to Dr John Curtis for having granted me access to the Silver Lyre for examination and for the presentation of the replica at the Museum.

My gratitude is extended to Dr Myriam Marcetteau who greatly contributed to the replication of the silver lyre. This was part of her Post Doctoral course with me. Heroically she spun wet gut strings despite of their putrid smell and carried out many other menial tasks leading to the replication of a remarkable instrument.

PART I - THE PAST

THE SITE OF UR

The ancient city of Ur is about three hundred and fifty kilometres south of Baghdad and two hundred and sixty kilometres from the north of the Arabian Gulf. Up to forty years ago the alluvial plain of the could be guessed from the top of the Ziggurat. To the south the mound of mud bricks of the ancient Eridu could be seen on a good day.

Today, to the west, the sand spreads to the North Arabian Desert. To the north and north-west are the distant hills of Sakheri, al-'Ubaid and Reijibeh. To the east the colour of the soil is darker because of agriculture. Far away on the horizon lies the expanding town of Nasiriyah now hiding the palm-lined Euphrates.



Figure 1. Modern map of southern Iraq.



Figure 2. Recent satellite photograph of the site. (Google maps)

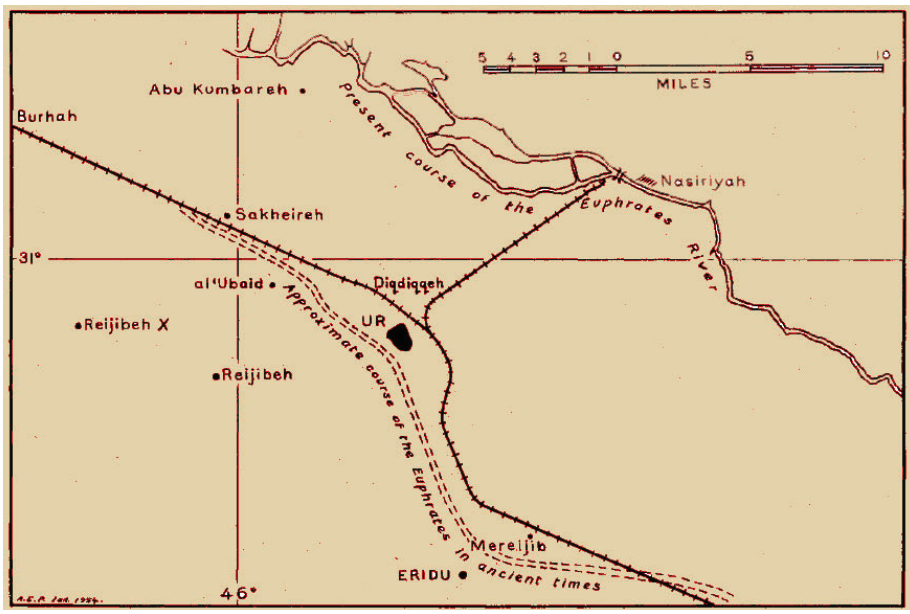


Figure 3. Woolley's sketch map locating Ur in the nineteen twenties. (BM archives)

THE DISCOVERY OF UR

In 1616 Pietro della Valle visited the site of Ur and brought back the first cuneiform clay tablets to Rome. Over two centuries later, in 1850, Loftus[1] who was member of a Turkish Boundary Commission visited the site and was intrigued by a mound locally known in Arabic as *Tell al-Muqayyar* which literally means 'mound of pitch' because of the bitumen used as mortar which oozed between the bricks of which it was built. The British Museum agreed to excavate the site. In 1853 the task was entrusted to Taylor who was the British Consul at Basra. The excavation was closed some time after the discovery of the foundation cylinders of King Nabonidus.

They confirmed that the mound located the site of Ur.



Figure 5. The Mound of Pitch as illustrated by Loftus in 1857.

For more than fifty years Ur was abandoned to the sand until Hall[2] took charge of the excavation on account of his success at *al-'Ubaid*. In 1922 Gordon, Director of the Museum of the University of Pennsylvania, proposed a joint expedition with the British Museum. The Royal Cemetery at Ur was discovered in the autumn of 1922, during the first week of the expedition. In 1919 Hall[3] had already cleared part of the palace of Ur-Nammu situated to the south-east end of the temenos enclosure. A bit further he found a clay dedication cone recording the building of a temple to NIN MAḪ, from which he concluded that the temple should be found a little further to the south-east.



Figure 4. Pietro Della Valle.

1 William Kenneth Loftus was born on the 13th of November 1820 in Linton, Kent and died at sea on the 27th of November 1858. He was a British geologist, naturalist, explorer and archaeologist. He discovered the ancient Sumerian city of Uruk in 1849.
2 Dr. Henry Reginald Holland Hall, MBE, FBA, FSA was born on the 30th of September 1873 and died on the 13th of October 1930. He was an English Egyptologist and historian.
3 Hall, Henry Reginald, *A Season's Work at Ur*, (London, 1930).



Figure 6. Leonard Woolley in the thirties. (BM archives)

The excavation of *al-'Ubaid* which ended in the winter of 1923-4 laid the foundation for our knowledge of the earlier period. It was with much more confidence that the digs at the cemetery resumed in 1926-7. During that season, over two months of work was done at the cemetery with about a 100 men. Mrs Woolley did some drawings and helped with field work. Mallowan[1] assisted and Burrows[2] translated some texts and inscriptions. Trenches were dug running out from the original one which had led to the discovery of the graveyard.



Figure 7. Max Mallowan, Agatha Christie and Leonard Woolley, standing (BM archives)

Woolley wrote that a trial trench was dug out to the south-east from the terrace wall of the palace to locate the NIN.MAḪ (Leading Queen, textually) temple. Another ran through a low mound north-east of the Ziggurat. It revealed the E.NUN.MAḪ temple (High Place of the Leading Prince, textually). The first trench did not show any walls but at different levels there were clay and stone vessels, bronze tools and weapons, beads and ornaments of carnelian, lapis lazuli, and gold but there were no skeletal remains. This was obviously the site of important graves. The work stopped because at that time too little was known of Mesopotamian archaeology. The objects from these graves had originally been wrongly dated to Neo-Babylonian or to Persian periods.

Seen from the air, the site of the cemetery is a patch of dark shadows from which radiate the ground where it was dumped. From the ground, walking across the ruins of the temenos, the cemetery is a large hole of about seventy by fifty-five metres, with a depth of about twenty. An area was cleared. It extended from Private Grave number 580 to a point at the south-east wall of Nebuchadnezzar's Temenos, not far from the South-East Gate. On the outskirts of the cemetery the graves were for the most comparatively poor. At the south-west, some graves lying close to the surface had been plundered, or destroyed and there was no great depth between the modern surface and the bottom of the grave stratum. There were all types of graves found there including incineration burials and it was already possible to distinguish the three main periods

in the cemetery. In 1930-1 the cemetery was abandoned because the work of the past four seasons seemed to have explored all that there was.

While it is certain that Woolley's meticulous archaeology not only resulted in the excavation of the oldest string and other instruments known to this day, but also to a gigantic wealth of knowledge about Mesopotamian culture. However, it is regrettable that his attitude toward the local Arabs was outrageous. In his own words:



Figure 8. Leonard Woolley and his wife at Ur. (BM archives)

'...It would be absurd to ask for a scientific interest in the work from men so ignorant as the Arabs of southern Iraq; they have no historic background, not even a tradition that goes back for more than two or three generations, and neither names nor dates can mean much to them; if they are pleased to recognize amongst the antiquities unearthed anything that seems familiar, that reminds them of what they do know to-day, it is because they are dealing with a world which is for the most part so impossible to understand.

Of course their main incentive is money, but they can be taught to take a more or less disinterested pride in doing a job well - that is for them a totally new experience, but they appreciate it, and a word of praise or a small reward for good work irrespective of finds has a great effect: they know that our object is not treasure-hunting but a search for some mysterious knowledge, and a workman digging in a barren spot where the chances of baksheesh are nil may be heard to comfort himself with the muttered phrase 'this is in the interest of science' not knowing what science is...' [3]

1 Sir Max Edgar Lucien Mallowan, CBE, born on the 6th May 1904, died on the 19th August 1978. He was a prominent British archaeologist, specialising in ancient Middle Eastern history, and the second husband of Dame Agatha Christie.

2 Ronald Montagu Burrows, born on the 16th of August 1867 and died on the 14th of May 1920. He was a British academic who served as Principal of King's College London from 1913-1920.

3 Woolley, Sir Charles Leonard, Ur Excavations, The Royal Cemetery, London 1934, Volume I, p. 9.

Plan of the Temenos of Ur

Third Dynasty, about 2300 BC
Showing the relation of the royal tombs to the buildings of the historic periods.

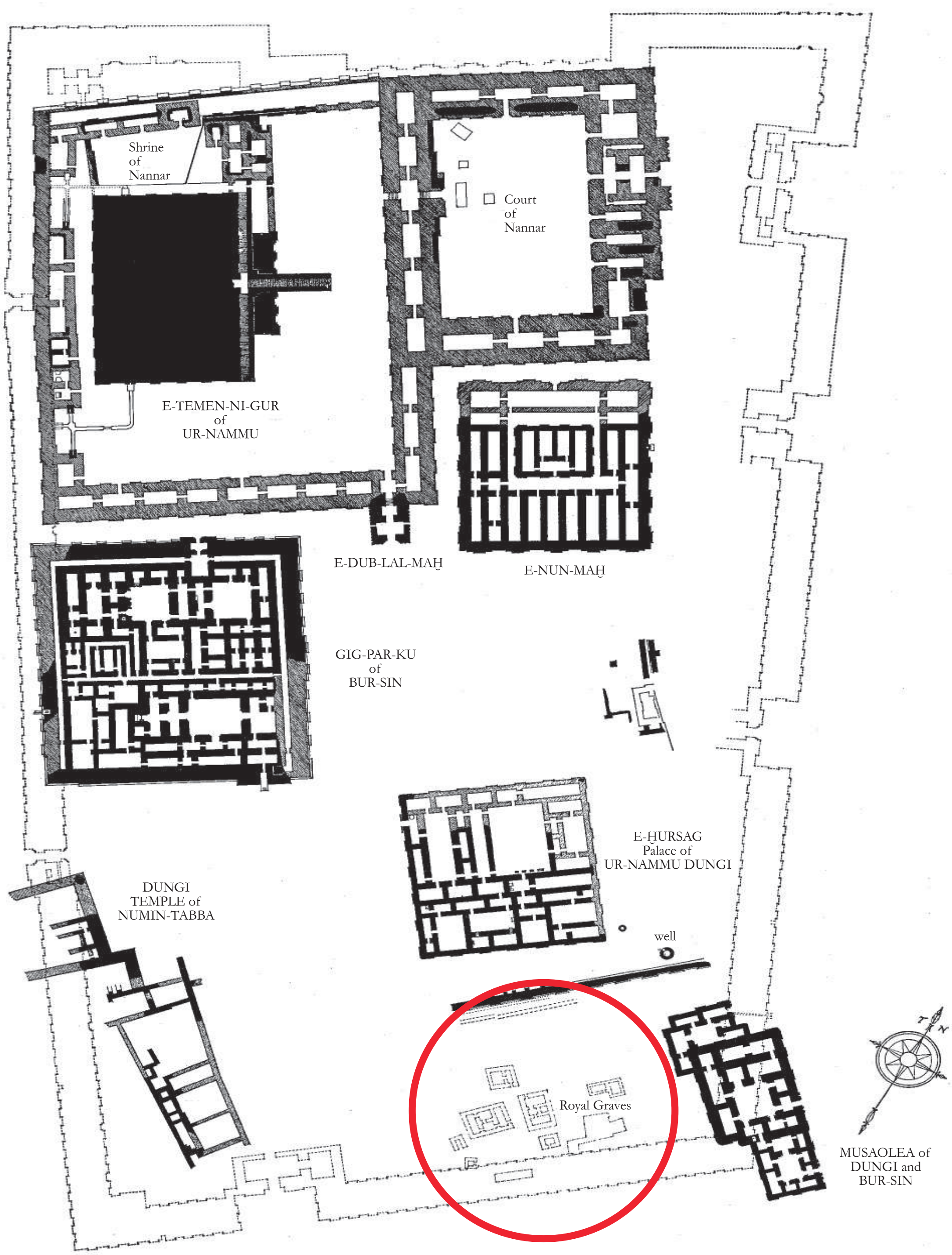


Figure 9. Plan of the site of Ur. The cemetery site is encircled. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 1)

Aerial photograph of the temenos of Ur

Third Dynasty, about 2300 BC
Showing the relation of the royal tombs to the buildings of the historic periods.

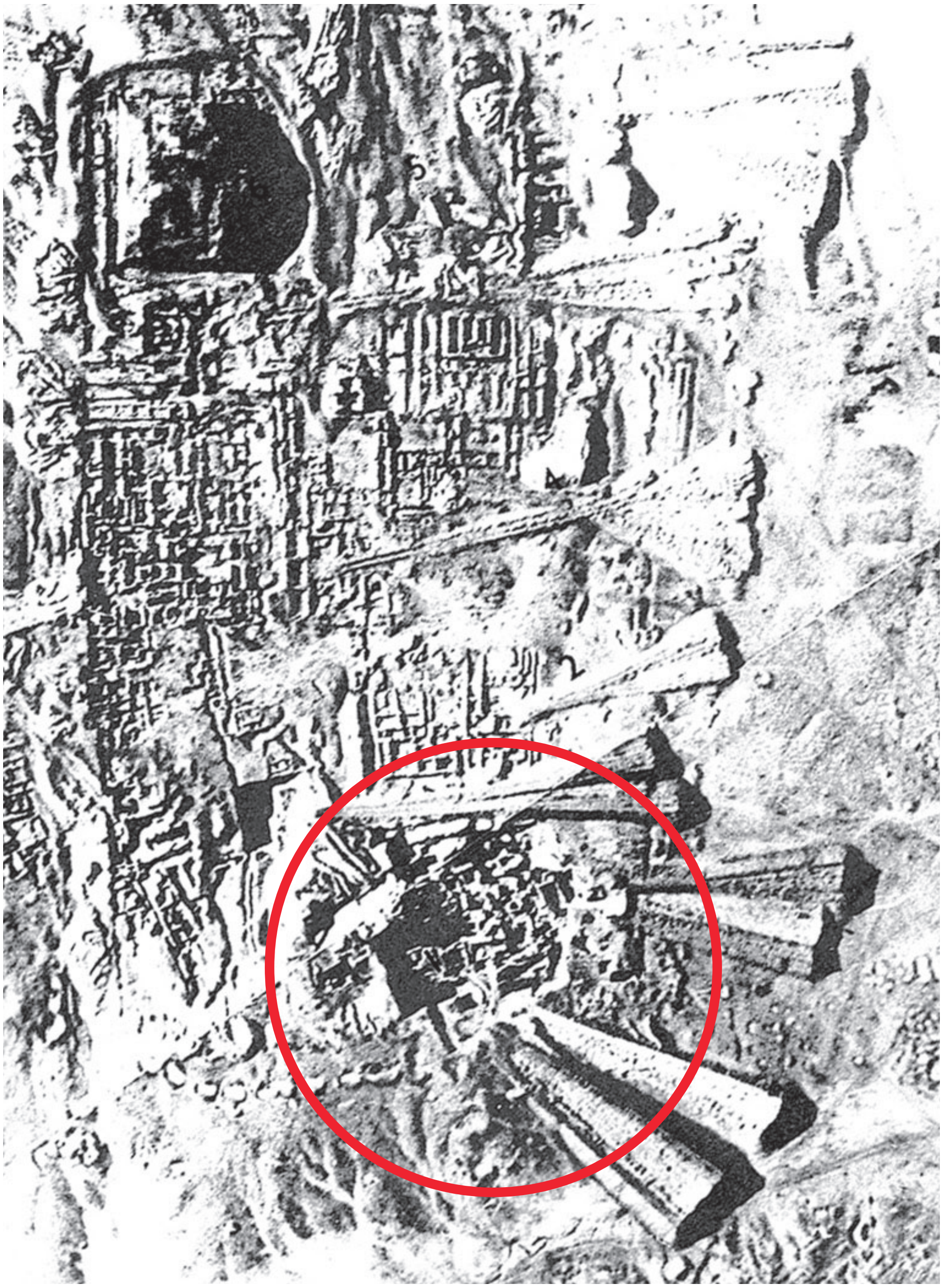


Figure 10. Aerial photograph of figure 8. The cemetery site is encircled.
(Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 2)



Fig. 11. Mrs Woolley, in black, at the bottom of the picture is drawing objects. (Woolley, Ur excavations, Royal Cemetery 1934, Pl. 70a; *v.p.* 113)



Figure 12. Recent photograph of the cemetery (encircled).

THE DISCOVERY OF THE LYRE

Woolley's account

'The lyres lay near the south-east wall of the pit, piled one on the top of another, all much crushed owing to the decay of part of the material of which they had been made and of the weight of earth which rested directly upon them; where the metal of the different instruments came in contact they had been fixed together by its corrosion and had to be forcibly separated. Both the silver lyres (excavation numbers U.12354 and U.12355) were crushed quite flat. The bodies had been of wood overlaid with very thin plates of silver, and the wood having disappeared the two metal sides had been pressed together with only a film of dust between; fortunately the dust was sufficient to prevent the sides from adhering to one another. The metal was not only cracked into innumerable pieces but was so completely reduced to chloride that it was in many places no more than powder which had to be solidified with wax. The whole instrument was, in each case, swathed in waxed bandages and strengthened with a wooden framework fixed to it by waxed binding, and so was lifted. In the laboratory the covering was left on while the sides of the sounding-box were separated with heated knife-blades and saws and fixed to a new wooden core made to measure; wooden and metal rods were forced up the interior of the uprights and cross-bar and fastened into the body; a certain amount of reduction was attempted on the silver, but could not be carried far, as there was practically no metal left; in the case of U.12355 it was subsequently found safest to give it a background of plaster to keep it from possible collapse. The lyres were at best but shadows of their former selves, but they have suffered only from time and burial and not in any way from reconstruction; they are faithful shadows.

The instrument was made of wood which had been entirely covered with thin sheet silver attached by small silver nails; down the front of the sound-box was a series of three shell plaques of which the lowest one was imperfect, attached to the front of the sound-box was a silver cow's head with inlaid eyes of shell and lapis, and round the edges of the sound-box ran a narrow border of shell and lapis strip inlay.

* PG stands for Private Grave and BM for British Museum.

As can be seen from the photographs the instrument as it lay on the ground appeared to be in good condition and the most accurate measurements could be taken. Its removal and restoration, however, presented serious problems. The metal sheath, reduced to silver chloride, was in brittle fragments or in powder, and the two sides of the body and the casing of the rectangular uprights had been crushed flat together. By the liberal use of wax and waxed cloth it was possible to lift it, but in this condition it could be neither kept nor exhibited.

In the laboratory therefore the uprights were detached from the body and, since it was impossible to straighten the bent and twisted metal, they were left virtually in their condition as found, but wooden rods were inserted in them and in the cross-bar and fixed together, and boiling wax was then poured round the rods until the misshapen tubes were filled; this was partly for strength, partly to prevent the further decay of the metal through exposure to the atmosphere. The two sides of the sound-box were then separated and strengthened from the inside (again waxed muslin was the only practicable medium) and a new wooden body was made to measure, the uprights fixed to it, and the silver casing replaced; the process entailed no disturbance of the shell plaques or of the head and very little reconstruction of the mosaic border, the position of which was in any case fixed by the groove left for it in the silver plate. The crushing of the instrument in the earth and the cutting of it open did result in the destruction of almost all the silver along the top and back edge of the sound-box; also the rejoining of the uprights to the body left a clumsy effect, principally because the silver along the top of the sound-box to which that of the uprights was attached had been bent out of the flat and with the distorted metal a clean joint was impossible. Some fragments of silver projecting under the back corner seemed to be the casing of a foot of the sound-box, and this was accordingly restored, with a front foot to match; that there were legs is, I think, certain; their original length must remain conjectural, but in this case they were made to the length of the silver plating that survived. The silver tubes (originally silver-plated rods) which were found attached by the corrosion of the metal to the cross-bar were not removed by us but preserved in their positions. The front end of the cross-bar is decorated with a shell roundel having a flower-rosette inlaid with red and blue.

The lower border or mosaic is continuous and shows no such aperture for the attachment of the strings as there is in the 'gold lyre', nor is there any hole in the silver plate of the table; on the other hand, on the right-hand table there are, starting from the bottom just above the border and immediately below the curve in the top of the sound-box, a number of white lines which diverge as they rise and can be traced for about half-way up the table. The silver plate generally preserves very clearly the impression of the matting with which it had been in contact in the grave, but between the point where the diverging lines break off and the upper mosaic border the mat-impression fails, as if something had here kept matting and silver apart. The white lines, of which eight can be distinguished, with more possible, must represent the strings, and it looks as if they had passed under the edge of the sound-box and been attached to its base; then they were taken across a bridge which for reasons of resonance must have been of wood and would have itself perished and, since it would have been loose, could scarcely have left any mark on the metal, but its presence is implied by the absence of the mat-impression. At any rate the position of the strings is assured by the lines of their decay and the method of stringing at the base of the instrument is in all likelihood correctly explained. But the cross-bar is most instructive. Against it there lie eleven short, slender, silver-plated rods, and

approximately corresponding to them there are on the silver of the bar bands of black stain which when the object first came to light showed in places the texture of a woven fabric of a rather coarse sort, like canvas; the bands, though not so distinct as at first (it was difficult to preserve them throughout the process of waxing and cleaning), are still quite visible. Now the rods appear on both the lyres on figures 15 and 16, as well as on that on a gold cylinder seal on figure 17 and also on the seal at figure 18; and on the donkey's lyre on figure 19, the strings seem to end at the top in something much broader and of a different texture. It would seem that the string was attached not directly to the cross-bar but to a canvas loop which passed round the cross-bar, and through this loop was put a rod which served for the fine tuning. Here again we have an eleven-stringed instrument, and it would be interesting to know whether by the tension (instead of by the length) of the strings it would compass the same scale as the harp of Shub-ad: the lyre figured on the 'Standard' also has eleven strings.



Figure 13. Instruments in their original position, U. 12354 to the left. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 76; v.p. 122 and Chapter XII)



Figure 14. The silver lyre, U.12354 at bottom and the ruined figures. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 75b, v.p. 122 and Chapter XIII)



Figure 15. Two lyres in their original position. U.12354 at top. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 76a, v.p. 122 and Chapter XIII)

DEATH-PIT - Private Grave 1237

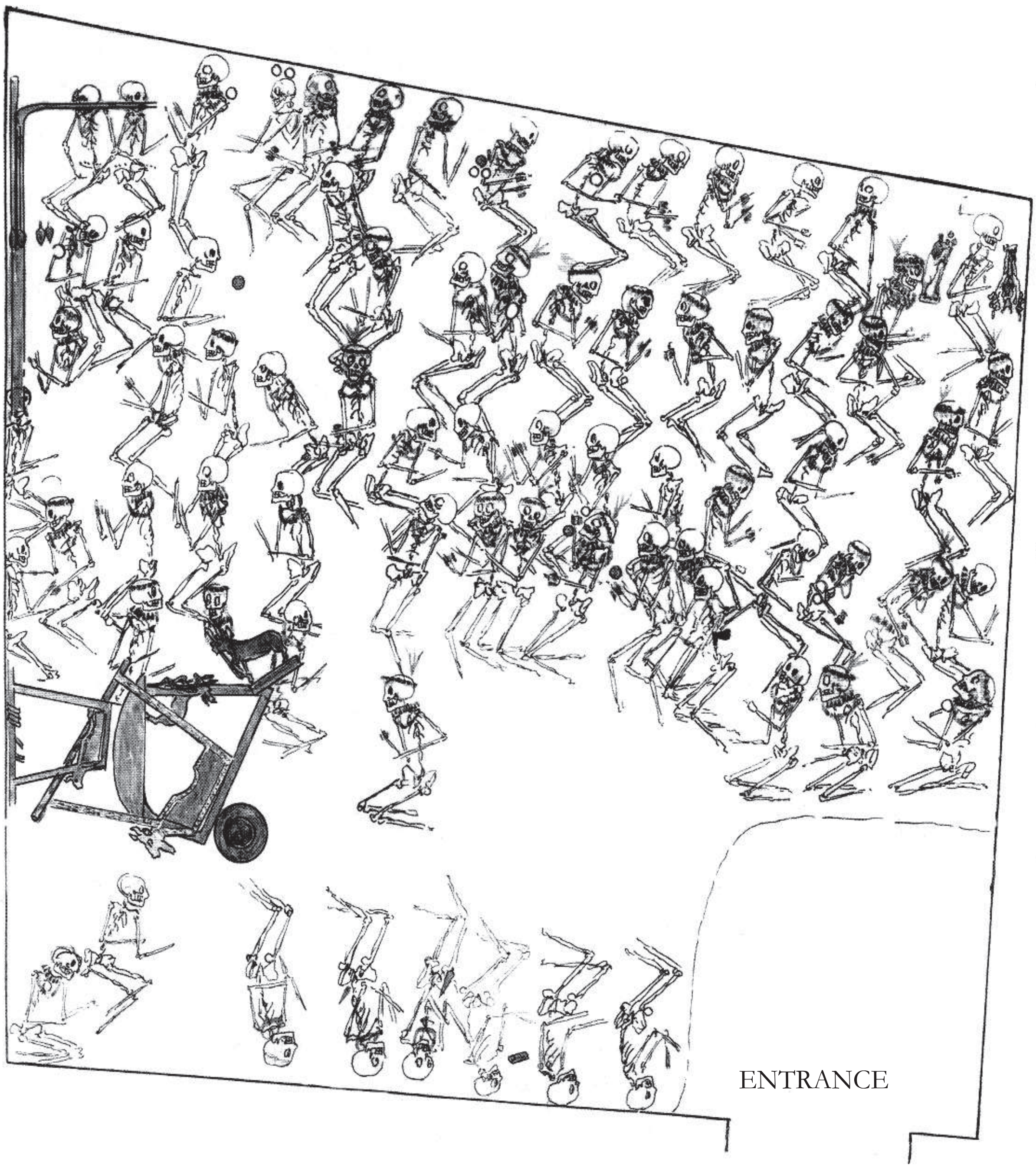


Figure 16. Drawing of the 'death-pit' with bodies in position, PG 1237, showing the lyres in situ. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 71, v.p. 113)

Woolley did not write much more about the lyres. There are only a few laconic entries in his field diaries.

The silver lyre was brought back to the British Museum where it was secured on a stand. During the unusually hot summer of 1949, the wax which held the instrument together softened and as a result, the yoke broke off the uprights. Years later it was decided that the lyre should be restored. This was completed in 1969.

I remember, as a young teacher in the early seventies, visiting the museum and being annoyed at the damage with which the lyre had been inflicted during its restoration. I decided that in time I would do something about it. It took me thirty-five years to come to it.



Figure 17. U.11904/PG 1054. Impression from seal of bitumen core with gold overlay. (Collon, D., 1987, p. 22)

This book opens a museum-old dilemma about the justification for the restoration of objects: Is the duty of the curator public presentation rather than academic conservation, and are museums places for popular entertainment rather than centres of academia. Is there a reasonable justification for brushing off centuries of paint from the Parthenon marbles because Victorians preferred them in the white? The history of every museum is burdened with such abominations which appeared legitimate at the time they were undertaken but have since become disputable and enhanced with the implacable arrogance of time. We think we know better today but in fact we are also committing actions which will be judged implacably in the future, no matter how scientific we believe our methods may have been. Therefore we must remain humble and never blame any predecessor for what mishandling they might have undertaken as in turn, we shall be judged. Past mistakes are part of the inevitable process of decay and any mishandling will only, meaninglessly, have accelerated the process, in the greatest scheme of time. Misquoting Seneca: *Errare humanum est, 'restituere' autem diabolicum.* Our duty is to conserve and never to restore.

The Silver Lyre has been one of the greatest and most infamous victims of museum restoration of all times. As it stands today it has lost all of its organological value. It is all but a ghost of itself, as Woolley put it.

The archives prior and during its restoration are the only reliable evidence. Thus the replication of the instrument that I have undertaken it in 2009 with the expert help of Myriam Marcetteau relied on the accuracy of reports, drawings and other important notes left by scholars, technicians and museum assistants having worked on the instrument since 1928.



Figure 18. U.12374/PG 1237. Impression from seal of lapis lazuli. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 194:22)



Figure 19. Part of a shell plaque from lyre U.10556 from Private grave 789. (BM Archive)



Figure 20. The Silver Lyre as it was exhibited at the British Museum until the Summer of 1949 when it collapsed. (BM archive)



Figure 21. The Silver Lyre after its collapse in the Summer of 1949. (BM archive)

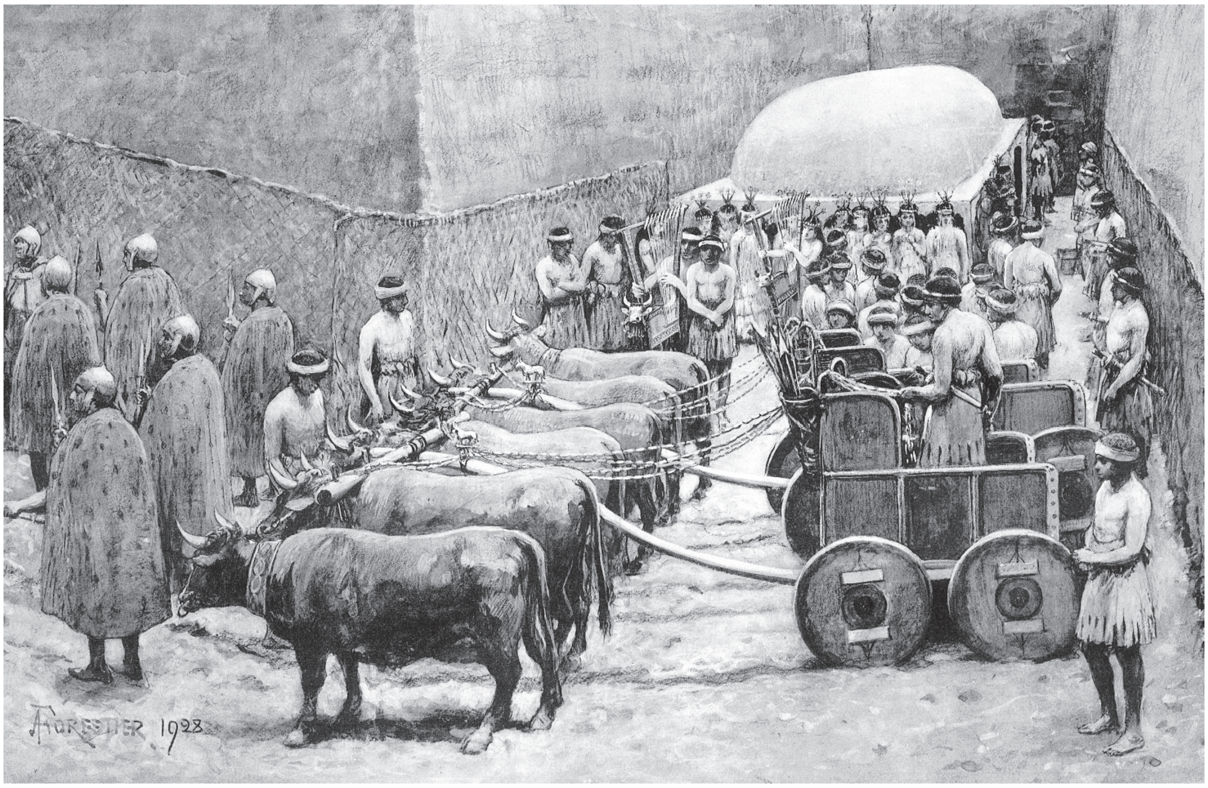


Figure 22. A reconstruction of the scene on the death-pit. The persons, animals and objects are drawn in the position in which their remains were found. Drawing by Amédée Forestier (1854-1930), originally for the Illustrated London News, in 1928. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 30)



Figure 23. Scene from the 'Standard' of Ur. (Woolley, Ur excavations, Royal Cemetery, 1934, Pl. 91)

THE RESTORATION 1962-1969

Extracted from the British Museum archives of the Near East Department

It is only as late as 1962, thirteen years after its collapse, that the restoration of the silver lyre was commissioned. Preliminary researches were conducted by Mr. R.M. Organ, who was at that time the Chief Experimental Officer of the Museum Research Laboratory. He was assisted by Miss Charlotte Podro, Museum Assistant of the Department of Western Asiatic Antiquities. Work was undertaken and completed by Mr. H. Barker, Principal Scientific Officer of the Laboratory and Miss M.E. McGregor, later known as Mrs Hutchinson, Conservation Officer in the Department of Western Asiatic Antiquities with help from Mr. A. Oddy, Scientific Officer at the Research Laboratory. Preliminary work consisted in removing the wax Woolley had applied, the carbonates and copper salts, and then as a result of two years of experimentation, the silver chloride was reduced electrolytically to solid silver by a new process later published by Organ and since known as 'consolidative reduction'[1]. This process allowed for all marks of strings, bridge and matting, braiding on the yoke by the tuning pins to remain visible on the consolidated silver as they appeared initially on the silver chloride at the time of discovery.

Conservation notes from October 1964 to May 1966[2] were mainly about silver consolidative reduction, application of synthetic bonding cements for the purpose of flattening silver flakes and other electrolytic methods all pertaining to the ornamentation of the instrument. But little was said of its organology. From May 1966, Hutchinson took over the conservation notes and her entry for the month of May 1966 says that most of the time was spent in surface cleaning of the silver calf's head from the lyre. She notes that the surfaces corroded and were extraordinary in structure, often appearing in layers of 'toffee-ish' material. It is possible that some fragments of glass may have been picked up as the corrosion expanded. Miss Brinson took a sample for X-ray defraction. The cloisons, however, in which the inlay appeared to be enclosed, could be caused by the corrosion enveloping something like insect eggs which had since decayed and their place taken by calcareous material. During September the mechanical cleaning of the calf's head was continued. Two experiments were made to find the softening point of the bonding cement without success. Information came from the Courteauld Institute about hot spatulas which were necessary for reshaping. Work continued on the soundbox.

[1] Organ, R.M., The Reclamation of the wholly-mineralised silver in the Ur Lyre, in: *Application of Science to the Examination of Works of Art*, Boston, Museum of Fine Arts, 1967.
[2] BM. 194.120/1 and 194.120/2.

Bonding cement was applied to all of the fragments which seemed like straightening themselves out unassisted. There was some lamination, but not a serious amount. In February work continued with reshaping the silver fragments of the yoke. During March work was done for reshaping the yoke of the silver lyre using dilators made of glass tubing. A sand bag for flattening the soundbox was made, filled and dried out. In April 1967 both sides of the soundbox were flattened in Mr. Bateman's kiln. This was a major operation which turned out successfully. The cement was taken off part of the soundbox with chloroform and the surface was shown to be detached over large areas. Wax had to be used to consolidate it. More of the yoke was reshaped and a start was made on checking the measurements for reconstruction. Some of the tesserae were de-waxed and measurements taken.

An attempt was made to turn over the edges of the soundbox. This was a failure as it tended to crack along the edge and flake off. There was also the problem of what to do when the edge was completely flattened where the strings converge. This object turned up to be just one frustration after another. In May 1967 the reshaping of the yoke and the removing of the cement from the soundbox was continued but the surface was breaking up badly. In June more cement was taken off the surface of the soundboard but this resulted in the surface breaking up badly. The string-side profile was laid out and the reshaping was completed except for a few small fragments. The right and left profiles of the lyre were laid out to check the size so that a wooden armature could be made. In October a mock-up of the only surviving leg of the lyre was made and used to see what shape it had been originally. More of the corrosion on the calf's head was removed and the original surface found. The armature on which to mount the lyre was drawn for the workshop and given to them.

It was discovered that the uprights of the lyre were concave on all four sides instead of only two as was previously thought. It was proposed to make the reconstruction infrastructure out of aluminium and plastic. This was considered to be easier for working on curves. In November it was decided to make the former of the lyre out of plastic. Various solvents were tried to get the cement off the surface but the silver still warped very badly. The cement could not be taken off altogether as the silver chipped to pieces. Attempts were made to take it off the front until the layer was so thin it did not show, and then was removed as much as possible from the back without danger of collapse. As there was no sign of the hydrogen furnace coming into general use in the near future attempts were undertaken to consolidate the only remaining leg of the lyre by means of electrolysis; at present all was proceeding very well. Various small fragments of the lyre were sorted out and reduced for patching. When the cement was taken off the front of the lyre, the silver warped. The cement was therefore taken off the back as well, on one fragment to see if lessening the strains on both sides would enable the warp to correct itself. It did not. A silver nail was treated by electrolysis for exhibition purposes. More attempts were made to correct warping none of which being successful. The leg of the lyre was washed free of caustic soda. Mr. MacIntyre made the finishing touches to the plastic mount, and the restoring of the lyre would start soon. Some of the cement was still being taken off the front of the silver and it proved possible to reshape it with cement but only on the back side of the lyre. In March 1968 the rosette from the front of the yoke was de-waxed and cleaned. Most of the cement was removed from the silver. Mr. conducted experimentation with the hydrogen furnace to determine whether it might work. In case it did not work the larger of the remaining fragments would be wired up

and put into electrolysis. The plastic mount was photographed by Mr. Bell both in one piece, and in an exploded view. Reconstruction of the yoke was nearly complete. No new or interesting facts were discovered beyond the rather extraordinary one that the rosette on the front of the yoke never fitted properly unless there was a row of inlay missing. There was some trouble with the wax which was not sticky enough but the addition of 25% beeswax helped cure this. The yoke was finished in June 1968 except for a final polish and tidying up and a start was been made on the main body of the lyre. The silver on one of the uprights was practically completed and so really overwhelming difficulties were overcome. There was a slight suggestion that the uprights might be trapezoidal in section instead of rectangular. The fragments of silver were stuck onto the plastic frame and the whole picture became clearer. Mrs. Jean Jenkins from the Horniman Museum came to see the lyre and made many useful suggestions, particularly as regards the stringing. In October the uprights wee finished and work proceeded on the soundbox. A visit was paid to Miss Jean Jenkins at the Horniman Museum to study the method of attaching the strings on the Ethiopian bagana. Plaster was removed from the front of the soundbox and the curling flakes stuck down with wax. The soundbox was slightly tacked in during November for a photograph and most of the inlay was stuck round it with bitumen-coloured wax of a high melting point. In December 1968 more of the silver was attached and the background and filled in by Miss Ludivici. The electrotype head was fixed on and all of the inlay except for the lapis lazuli and shell on the proper left side. The yoke was put on and the carpenters made eleven wooden tuning levers to be used on the original for photography purposes and possibly later on a model. In January 1969 details of the stringing had been worked out and done. After trial and error, it was decided that the lower end of the strings were tied onto a loop of some sort. A piece of leather thong was used. The soundbox was fixed on and the inlay stuck round it. Miss Ludivici filled up the gaps with coloured wax to match the silver. A bridge was made and the lyre was photographed both in black and white and colour. This took three attempts but was successfully achieved. Work continued on the other half of the soundbox. In February 1969 the text for a label was discussed with Mr. C.B.S. Walker. The other side of the soundbox was flattened, or at least an attempt was made but the silver kept curling. At last Miss Ludovici suggested a method for attaching the silver and this was successful and the inlay belonging to this side was put on and the missing pieces on both this and the other side were made out of tinted synthetic glue. The socket was fixed in its correct position in the yoke and the back edging of the yoke and fixed on again by Miss Ludovici who identified many more unlabelled fragments. It was arranged with Mr. Oddy that he would reduce some remaining fragments by means of hydrogen and these pieces were taken over. March was devoted entirely to finishing the silver lyre with Miss Ludovici's assistance. The silver was all fixed on, polished and lacquered and the wax painted with real silver to prevent electro-chemical reactions. The lyre was strung using parcel string, wooden levers, and a wooden bridge but would eventually be strung with gut, and proper levers and bridge. The area round the convergence of the strings was not touched at all except for a slight polish lacquer. In the research laboratory Mr. Oddy reduced some fragments with hydrogen but they came out even more fragile after this treatment than after consolidative reduction. In April 1969 Ian McIntyre made the plastic tuning pins, and a plastic bridge. In June 1969 the lyre was somewhat hurriedly strung for a Trustees' meeting. However it was later restrung with nylon as gut was thought too springy with too

great a response. In July nylon was bought and the lyre was finally strung with it and with silver painted wooden tuning pins. In August 1969 the lyre was placed on temporary exhibition waiting for the label to come back from the printers after which the case was altered and arranged in its permanent position. The early part of the month was spent restringing the lyre yet again, mounting the original tuning levers and attempting to polish the plastic. In October 1969 the lyre was properly photographed and its permanent position in the altered case. The notes on the reconstruction were written up and typed.

Silver consolidation

Mr Organ's conservations notes consist firstly in the method for silver consolidation and mainly say that in the case some other badly crushed object had to be restored he would recommend electrolytic consolidative reduction which gave much better results than did hydrogen reduction where it was tried. Only small fragments were reduced in the hydrogen furnace but almost invariably they ended up with the three layers of the corrosion separating into detached flakes which were impossible to get into register and stick together again. They just broke up. Fragments which were reduced by electrolysis very rarely did this even when they had only been backed with wax which was later removed. If they laminated, it was usually as the result of hand-ling, attempts at flattening, or warping of the cement on the back. The same synthetic bonding cement was used to back the fragments of the lyre as it was said to be very easy to remove completely using heat, should complete removal become desirable at some future date. It would volatilise completely leaving no black residue behind. However, the silver would not stand this in any case, and surely acetone would remove enough cement to enable another backing to be put on if anyone should ever have fresh ideas. The way that cement shrank rendered it quite unfit for this sort of purpose, *i.e.,* painting thin layers on the back of thin fragile objects to strengthen them. However much one anneals the plastic to even out the stresses, or gently heat the object and flatten it, the cement will always warp back, even if the fragment is allowed to cool, even with a 7 pounds weight on top of it.

The cement should apparently be covered up while it is setting so that part of the mixture does not evaporate before it has done its job. Everything that was tried to cover the cement was disastrous; the cement wetted even polythene and silicone paper and heave itself into thick layers over part of the area, while almost disappearing from others. Sometimes it finished up as a very thin film lightly adhering to the covering material. In the case of dental wax, the pink colouring was transferred to the cement as well. It would have been far better to use wax, either dental in sheets, or even a wax painted onto the cold fragments to support the fragments and insulate the silver wires during electrolysis. This was done on some fragments, successfully. Then, before the backing was taken off, the fragments could be impregnated with something which could be readily removed from the surface. This was very necessary, as the cement proved impossible to remove from the surface of the lyre where unevenness in the surface allowed a thick layer to build up. These patches had gone very yellow and had to be painted out. The impregnating plastic should also become very flexible when heated to allow for re-shaping, and either be not too strong – so that the silver will win a trial of strength – or only shrink very little. Perhaps a dilute cellulose lacquer might have been better.

The restoration

Two considerations had to be born in mind when deciding of what the frame on which the lyre was to be reconstructed was to be made. The first requirement was that it must be fairly light as the lyre is very top-heavy owing to its excessive height in relation to its width. It is about ten times as high as it is wide, and this also meant that a wide or heavy base firmly fixed to the lyre was essential. The other consideration was movement. It was thought essential that the frame should not move in response to moisture, changes in humidity, or temperature variations. If it did move, it would put strain on the fragments and with the adhesive used to fix them and might push them off entirely in time. In addition, of course, the frame had to be strong and rigid.

In the end rigid plastic was chosen as it combined the greatest number of desirable characteristics. It is light and surprisingly rigid, though the yoke has an 'L' shaped aluminium girder going down in the middle of the tube used to prevent it sagging through the weight of the wax and silver and the pull of the strings, which would have to have sufficient tension on them to keep them straight. The chosen adhesive which was wax will stick to it and it has a low, if any, response to temperature and humidity variations.

As the under surface of the silver was far from flat, even after reshaping, it was obvious that the adhesive would have to be used as a gap filler as well. It must also adhere to the cement and not perish with age, neither must it be affected by moisture in the atmosphere. Wax was thought best and a microcrystalline one with a high melting point was selected. However, it was not sticky enough, so 25% beeswax was added. This made the wax far better as an adhesive without reducing the melting point enough to matter.

The plastic frame was made by Mr. Ian Macintyre. It was photographed, and a detailed drawing made showing how it was put together. Recesses were cut in it to take the original silver nails which had once fastened the silver sheets onto the wooden frame. The large piece of plastic on which the lyre stands is in fact slotted into the body so that the lyre can be taken off and to stand on its own for photograph or other reason if necessary.

The plastic was first covered thinly with the wax using paint brush and spatula, one member of the lyre being done at a time. A fragment of silver was then warmed, and the appropriate area of wax softened with an industrial blower. The piece of silver was then placed in position and the blower played on the face of the fragment while very gentle pressure was applied, until the silver was thought to be secure. If one of the flat fragments was warped out of its proper shape owing to the cement on its back, this warming gave a last chance to flatten it again as the heat was enough to make the plastic flexible.

The inlay

Wax was coloured with brown and black powder colour to simulate the original bitumen, and a little vacuum wax was added as this made it look much more realistic. The tesseræ were picked up individually with tweezers, dipped in the liquid wax and placed in position on a bed of coloured wax which had been softened locally by means of an electric soldering iron. Excess wax was removed when semi-set, and the tesseræ cleaned with a swab dipped in toluene. The rosette on the front of the yoke was treated in the same way, and so were the shell plaques decorating the front of the calf's chin.

It was decided at this point that the lyre was to be displayed strung, as there was otherwise no way of showing how the tuning levers worked, they being held only by the strings. This meant that all the gaps where the silver was missing had to be filled in for appearance's sake and the same wax mixture coloured a light grey was used for this. It was then painted with flake silver so as not to distract the eye, but no attempt was made to make it look like the original silver sheet. Finally the whole of the silver was lightly polished and lacquered and those places where it had proved impossible to remove the cement from the surface were covered with flake silver as the cement had gone yellow.

Stringing the lyre

From the marks left by the decaying strings in the surface of the corrosion it was possible to see that there were eleven strings. The marks also allowed to determine the position of the bridge together with its dimensions, and how and where the strings fastened onto the yoke. The only piece of information missing was how the strings were fastened at the bottom of the soundbox. It could be seen that the strings passed over the bridge and then converged in a fan-shape until the edge of the central silver panel, but beyond this point there are three rows of lapis lazuli and shell inlay in a band two centimetres wide which showed no marks at all and beyond this, the two centimetre silver edge is missing. The angle of convergence, however, suggested that the strings were fastened to a fairly small loop of some material rather than to a stick secured at the ends as on the Ethiopian bagana. On the horizontal yoke were the marks of eleven pieces of braid which had originally been tied round under the strings to give a increased area of friction and thus secured the tuning of the lyre. Revolving the braid and strings round the yoke tightened the straight length of string passing over the soundbox, and this is how the lyre was tuned. A lever of silver-covered wood was placed in the winding of each string to facilitate this. It was initially decided to string the lyre with gut as this was probably what had been used originally, but experiment showed that, using gut of the proper weight to look right would mean a pull of at least fifty pounds on the yoke to keep the gut free of kinks, let alone taut. Monofilament nylon was eventually used, tied round a loop of leather at the bottom of the soundbox. The braid over which the strings were wound round the yoke was made from two thicknesses of naturally coloured wool of the desired length using the forefinger as a crochet-hook. Judging by the marks on the yoke this is not absolutely correct in pattern but is right in idea. The original was certainly not woven or plated.

The size and position of the bridge could be seen from the marks left in by the original bridge as it corroded and was revealed by the silver chloride, but the decision to make it movable and three-sided, and also its height from the surface of the soundbox, was based on comparisons with the Ethiopian bagana, an instrument of the same size, basic shape and family which might possibly be a direct descendant of the Sumerian lyres.

The bridge was made of plastic so that no one could think that it was original. On examination, it was decided that the lyre's own tuning levers were too fragile to be used, so new ones were made of plastic. These however, were disliked by the Trustees, so painted wooden ones were substituted. The problem still to be solved was what to do with the real silver calf's head from the front of the soundbox. The eyes are made of white shell, black limestone, lapis-lazuli, of which only the lapis is removable. The shell and the limestone are jammed in preventing the use of electrolysis to remove the silver chloride from the head. This is a pity as enough of the corrosion layer will flake off at

the original surface to let it be seen how very finely modeled the head is. If the head were electrolyzed there would be grave risk of the eyes becoming stained with silver salts, even if they were not attacked by the electrolyte.

Conclusion

The accounts from both Mrs. Hutchinson and Mr. Organ clearly expose an approach to conservation which is mainly in contradiction with the practice today. Indeed both scientists were essentially concerned with an aesthetical reconstruction of the lyre, which they did with very high competence, but to the detriment of the organology. It must be said in their defence that the science of musicology had just come to recognition and that there was no approach methodology to the conservation with regard organology, let alone archaeo-organology. This is clearly seen in the amount of notes relating to the silver chloride reduction and techniques for consolidating it onto a new infrastructure, compared to organology *per se*. As a result much has been lost as indeed most of the silver border of both sides of the soundbox and at the top of the uprights was mainly reconstructed from flakes of silver left over from other parts of the lyre and missing parts were replaced with synthetic fillers thus preventing accurate measurements and other traces essential to the organology. It is also clearly seen that the tesseræ which were lifted at some point of the reconstruction for the purpose of silver consolidation were not always put back in their initial position even if their original location had left their imprint in the silver facilitating such repositioning. This is particularly obvious with the registers at the front of the lyre where much of the tesseræ affixed in the 1960's reconstruction are inconsistent with Woolley's original photographs.

Very little organology can be learnt from Hutchinson and Organ's reports because their work, as much laudable it had been at that time, has caused irreparable damage to the instrument - they chose aesthetics in priority and to the detriment of the organological evidence - a difficulty choice. The rule is that in the case an item, which is unique, is unearthed, it should not be manipulated in any way which might mask or erase any of the evidence it holds. The object must be conserved in an inert environment to prevent any further decay until such a time when science may offer reliable solutions for undertaking any further investigative and, or conservation work. This is precisely what Woolley, very rightly, did. In fact much more has been learnt from his photographs and reports than from the last reconstruction efforts, regrettably, with the exception of the observation drawings, it must be said. The collapse of the item in 1949 should have prompted curators to display the silver lyre flat after appropriate observation drawings and notes on the archaeo-organology had been taken, and leave it without further interference. Thus whilst I have felt it necessary for reasons of academic recording regarding the conservation of items, to convey the conservation notes from the 1960s, I must stress that only very little from these has served organology.



Figure 24. Plaques and tesserae as originally placed on the lyre, to the left, and their repositioning in 1969 to the right. (Woolley, 1934, Pl. 105). This shows that the restoration was careless as the tesserae have not been replaced in their original position. Note that at the lowest register the scene has been placed at the centre. Another lion would have ensured symmetry as it is above.

PART II - THE PRESENT

THE EVIDENCE

The corpus of evidence is kept at the Department of the Middle East at the British Museum in two boxes referenced as 194.120/1 and 194.120/2.

1 Craft paper with mock-up of soundboard, right side with tesserae.
2 The same but with no ornamentation. Sizes are inconsistent.
3 Drawing of an upright.
4 Photograph of a fragment of the inside foot of an upright showing traces of wood.
5 Tracing paper with drawing of the right side of the yoke.
6 Film with marks of the bridge on the soundboard.
7 Tracing paper drawing of the right side of the yoke.
8 13 pages of various conservation notes.
9 Roll of sheets with various drawings.
10 Roll of technical notes on silver treatment.
11 Roll of craft paper detailing the yoke.
12 Photocopy of the soundboard and part of an upright mentioned in 4 above.
13 Roll of drawings of the front upright, both sides.
14 Roll of drawing of the yoke, front and back.
15 Roll of drawing of the other upright.
16 Drawing of 'Proper left side'.
17 Film of the back of the soundboard.
18 Film of the reconstruction structure of both uprights.
19 Film of the front of the soundboard.
20 Drawing on craft paper of upright.
21 Same as above.

There are additional diaries, notes, reports and photographs which will be reproduced here whenever relevant.

The silver of the lyre

On the 19th of August 1970, the National Museum of Antiquities of Scotland delivered the following report from a sample of silver form a tuning pin (which had been wrongly labelled as 'Ur Paddle'), to Dr. R. D. Barnett, Keeper of the Western Asiatic Antiquities of the British Museum:

Samples of corroded silver from Ur was reduced back to the parent metal then subjected to chemical analysis by atomic absorption spectrophotometry. (fig. 25, a to g) The results obtained are as follows:

99.7	%	Ag
0.17	%	Cu
<0.01	%	Pb
<0.05	%	Bi

The result for copper, although a low value, was measured quite accurately since the technique is particularly sensitive to this element.

In view of the completely corroded state of the sample and the negligible lead content measured, it would appear at first glance that very little could be derived about the lead content of the original metal. However, consideration of the likely corrosion products formed and their relative solubilities in water, does lead to reasonable conclusions. Thus the likely copper corrosion produced is cuprous chloride and the likely lead corrosion produced would be a basic carbonated. Silver would of course corrode to silver chloride. The solubilities of these three corrosion products are respectively 0.0062, 0.0001 and 0.00009 gms in 100 ml water - the lead corrosion products is thus less soluble (about fifty times less) than the copper corrosion product and the fact that a fair amount of copper was still present in the corroded metal would clearly indicate that the lead corrosion products should have survived dissolution by percolating ground water. In view of the absence of lead upon analysis it would seem reasonable to conclude that this was due to there being very little lead present in the original silver.

The analysis of many hundreds of early British silver objects and coins has invariably revealed a lead content of about 1%. A laboratory lead cupellation experiment using a prepared initial alloy of composition:

71.4	%	Ag
14.3	%	Cu
14.4	%	Bi

- yielded a silver button of composition:

97.8	%	Ag
0.3	%	Cu
0.9	%	Bi
1.0	%	Pb

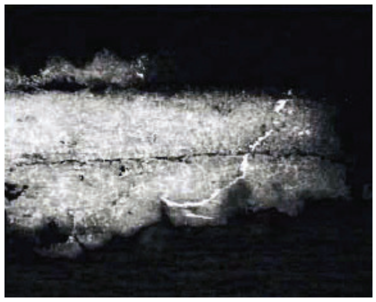
- the typical 1% lead content being again obtained.

It would thus seem very probable that all silver prepared by lead cupellation would contain a residue of about 1% of lead.

The low content of lead predicted for the Ur silver would seem to indicate that the method of obtaining the silver was not lead cupellation. The use of sulphite extraction seems even less likely and it would seem probable that the metal used was naturally occuring native silver.

This can of course be no more than a tentative conclusion based as it is upon rather negative evidence. The removal of lead as the relatively soluble chloride would seem fairly unlikely however and the conclusions drawn should therefore be correct.


Figure 25a.


Figure 25b.

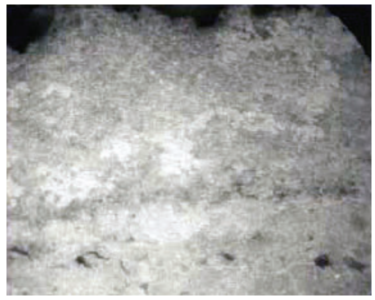
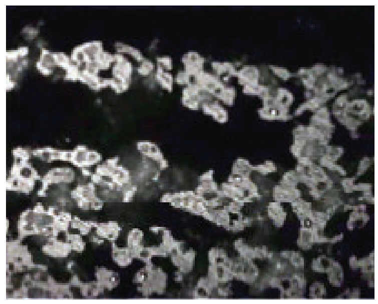
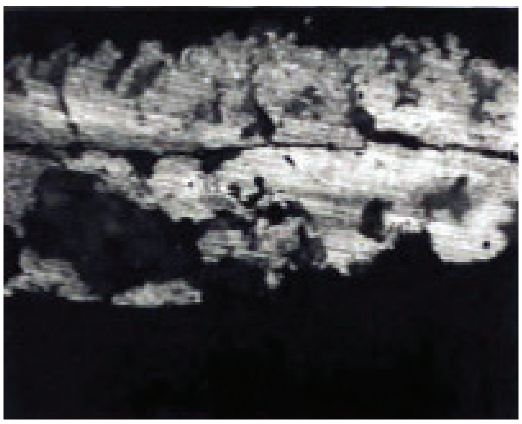

Figure 25c.


Figure 25d.


Figure 25e.


Figure 25f.


Figure 25g.

Figures 25, a to g. Various micrographic photographs of fragments of the silver from a tuning pin of the lyre. (British Museum Archives)

The wood of the lyre

Six samples of wood from the silver lyre were sent to the Forest Products Research Laboratory. The samples came from the back of the sound-box, left side at the bottom; back of the sound-box, left side at the middle; back of sound-box, left side; wood, and silver chloride and low-melting point paraffin wax, exact position unknown; inside back upright, fragment 1, left side; from tuning pins. All samples were returned but none could be identified and were all described as 'fine-textured hard-wood, unidentifiable. Other essences from various items and from various locations sent at the same time as the lyre samples came from Nimrud; Ur; Abu-Sharain; Jericho and from the Balawat gates. They included cedar of Lebanon; poplar; palm and judas tree.

Out of these species, only cedar of Lebanon and Judas tree would have been suitable for the uprights and the yoke while poplar would have been ideal for the frame of the sound-box.

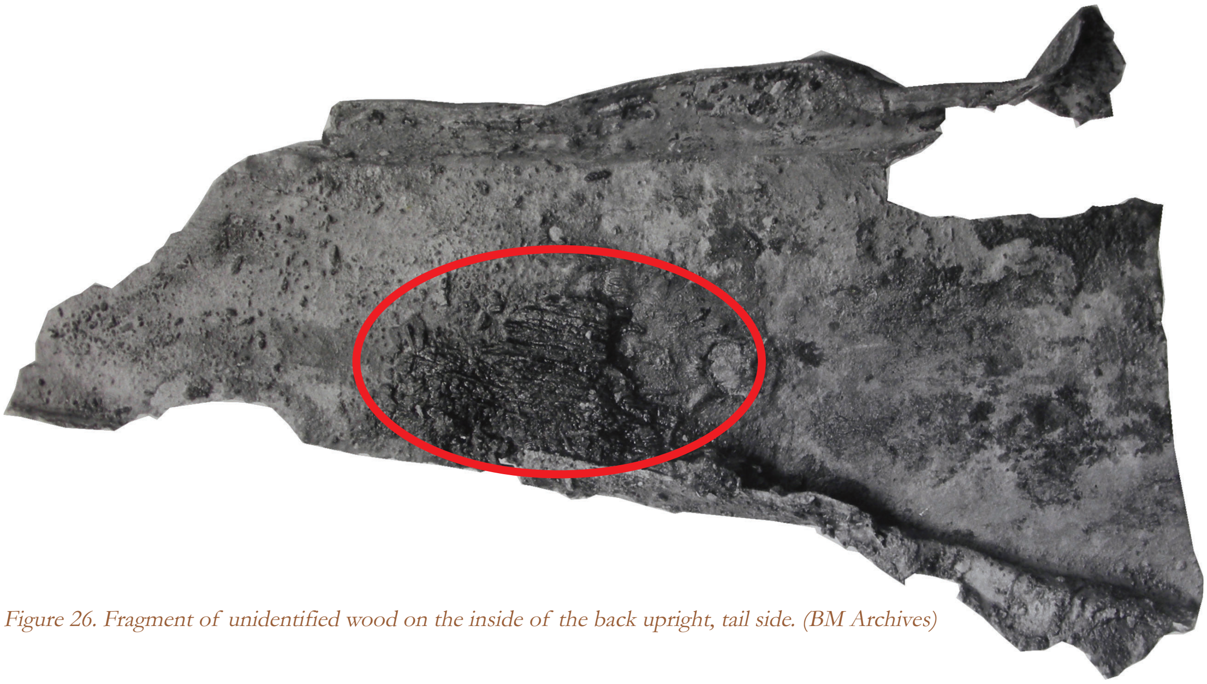


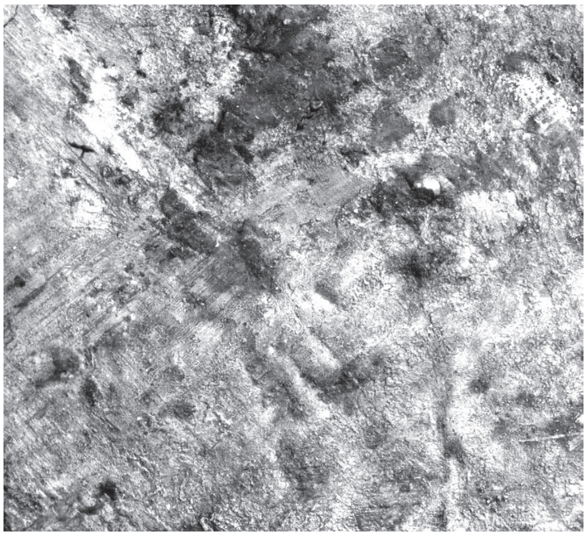
Figure 26. Fragment of unidentified wood on the inside of the back upright, tail side. (BM Archives)

Silver soundboard



Figure 27. Bridge-side of the soundboard. Photograph taken prior to the restoration of the lyre. (BM archive)

The soundboard laid bridge-side to the ground and shows the marks of the mating which covered the ground of the chamber (fig. 27, left and details on 28 and 29 below). Figure 27, left, bottom of the picture, shows the impressions left by the eleven strings with which the lyre was strung. Figure 31 emphasizes the marking of the strings with white lines. Figure 30 below shows the emplacement of the bridge. It will be noticed that there is no evidence of any form of fixation of the bridge to the soundboard. This suggests that it was held in place by the tension of the strings, unlike with the boat-shaped lyre at figure 12, (Appendix I, U. 12355 found in PG/1237) where the bridge was shaped in *repoussé* from the soundboard itself and was therefore an integral part of it.



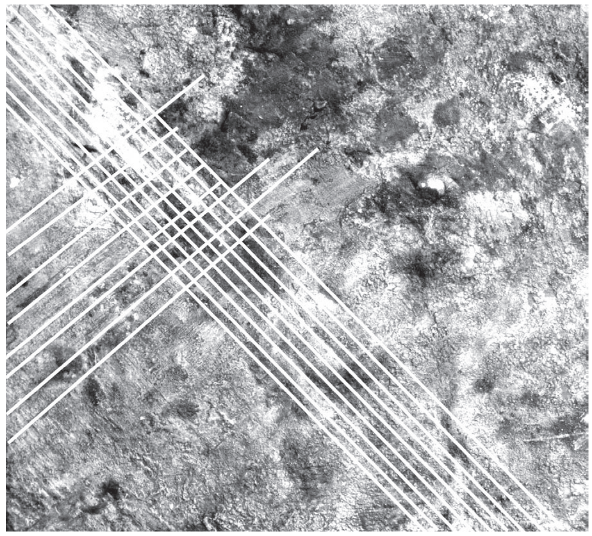


Figure 28, left and right with lines to emphasize the matting of the tomb. (BM archive)

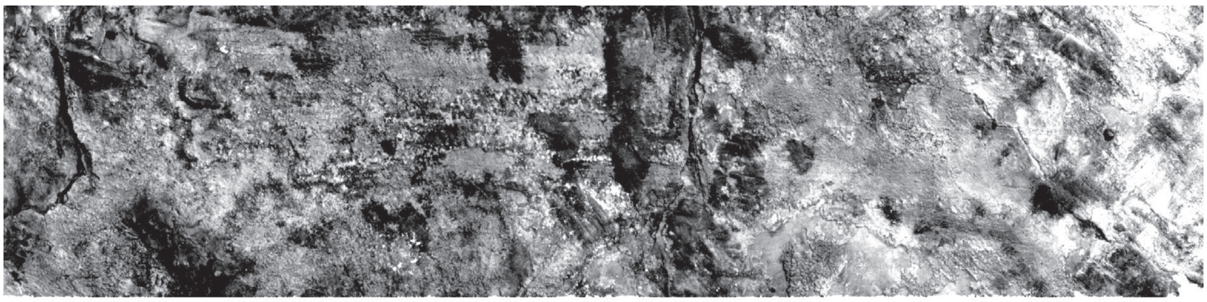


Figure 29. Showing the marks left by the bridge on the soundboard. (BM archive)

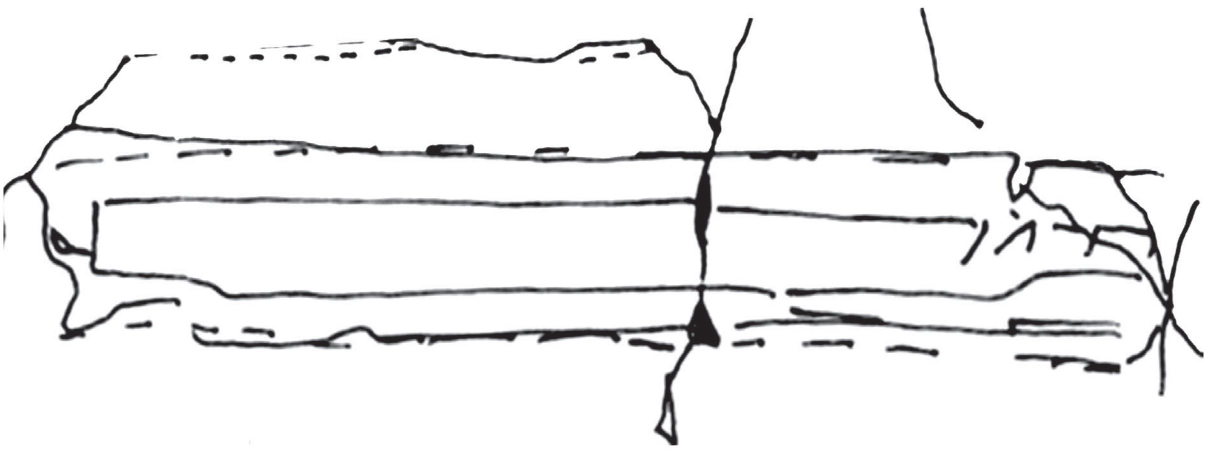


Figure 30. Top, Showing marks left by the bridge on the soundboard, line drawing of above. (BM archive)

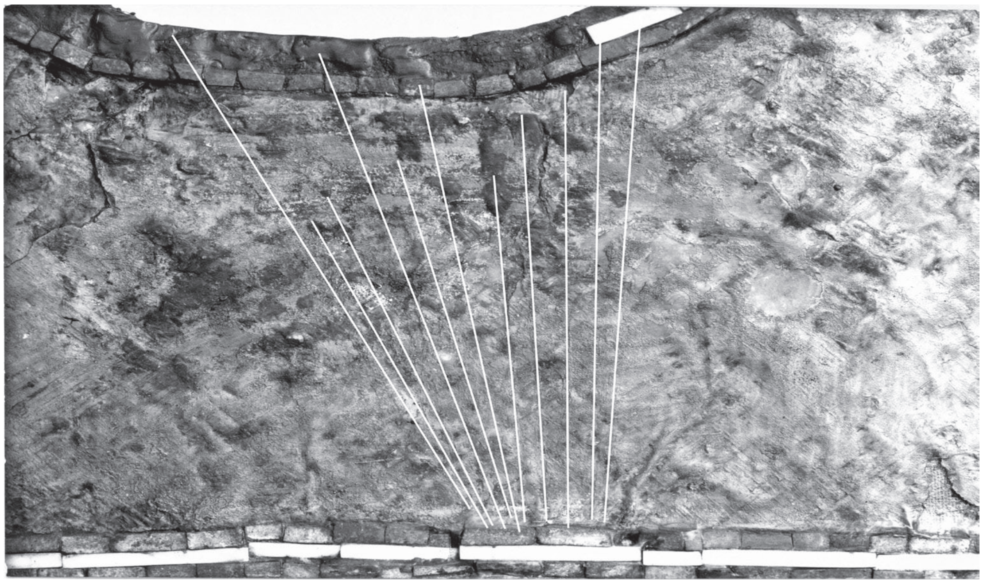


Figure 31. Showing the lines where they left their impression on the silver. (BM archive)

Figure 31, above and 32, below, show that the soundboard *per se* was delineated by a triple row of tesserae from which it was independent. This implies that the infrastructure of the silver lyre consisted of a frame onto which the soundboard was placed. Woolley described that there was only a thin layer of dust which separated both silver plates of the soundbox: The soundboard proper, and its opposite counterpart. This clearly indicates that contrarily to what was believed, the soundboard was made of a stand-alone plate of silver and that it was not glued or affixed to a wooden soundboard placed under it. There is also strong evidence that the silver soundboard was given a 'belly', that is it was slightly convex, as Woolley had suggested, in order to prevent it from concaving under the pressure of the strings. This would also in keeping with the boviform aspect of the soundbox representing the body of the bull.

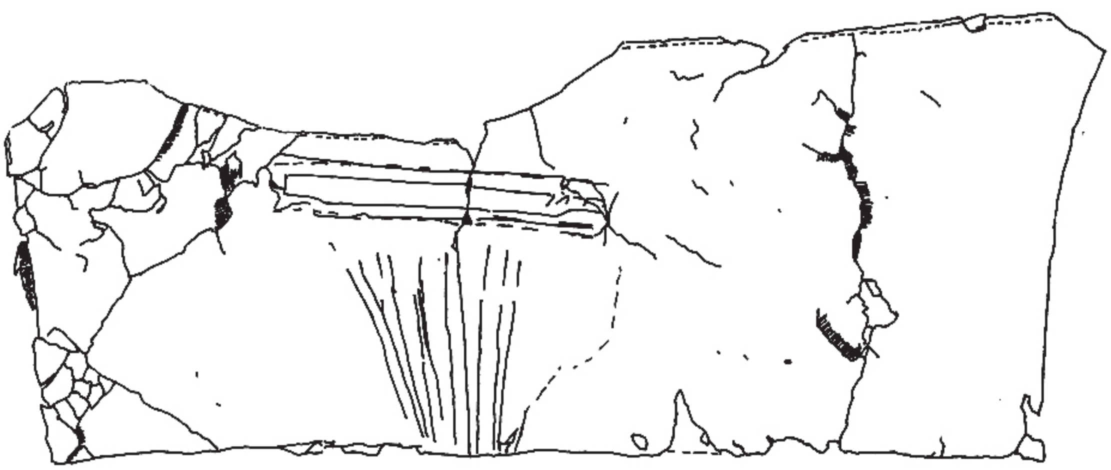


Figure 32. Drawing of the soundboard showing that it was distinct from the tesserae that framed it. (BM archive)

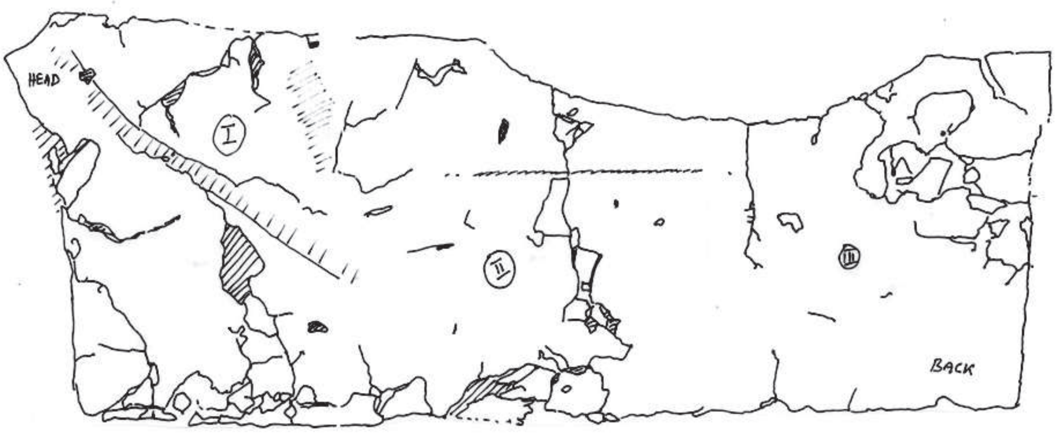


Figure 33. Drawing of the side opposite to the soundboard. (BM archive)

Thus the hypothesis that the soundboard had been made of a thin leaf of silver glued to a wooden soundboard had not been thought through organologically since the bitumen that would have glued the silver to the wood would have dampened the sound of the instrument. Metal soundboards have been used on various instruments such as Dobros and on pianos shipped to India during the British Raj. Metals have enormous advantages over other materials as they are insensitive to hygrometric variations unlike wood which would have split whenever the hygrometry dropped. The lower Mesopotamian plain, north of 30°N, is in the submediterranean subtropical belt, with a local arid character (60-170 mm.yr-1 rainfall) counterbalanced by the fluvial freshwater input from temperate mountains, via the Tigris and Euphrates. Evaporation fluctuates from 50 to 250/600 mm a month (January and July means), highest in July heat (31-35°C, up to 50°C). While raw hide soundboards would have been the favoured medium, it is certain that silver would have had the advantage of producing a much clearer sound since sound conductivity with this metal is much higher than it is in leather or with dried raw hide. Dried raw hide does not split. However, it will tend to loose its elasticity with rising hygrometry unless it is protected by some hydro-repellent varnish.

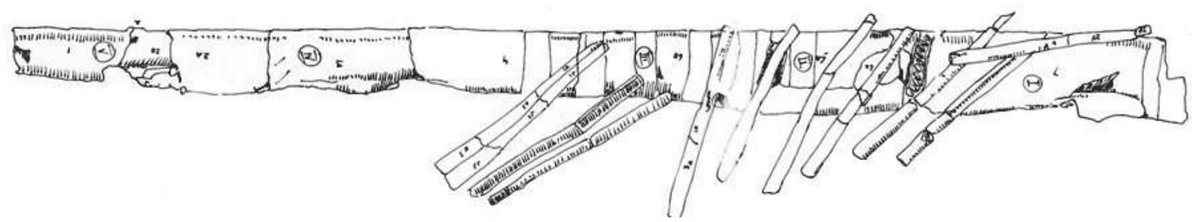


Figure 34, left side of yoke. (BM archive)

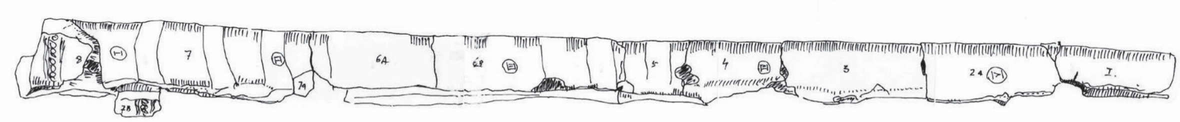


Figure 35, string side of yoke. (BM archive)

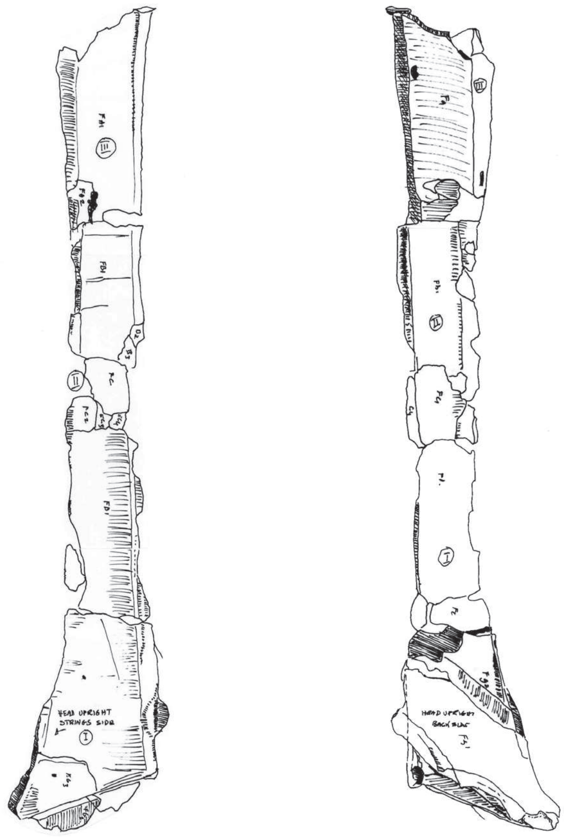


Figure 36. left and right sides of head upright. (BM archive)

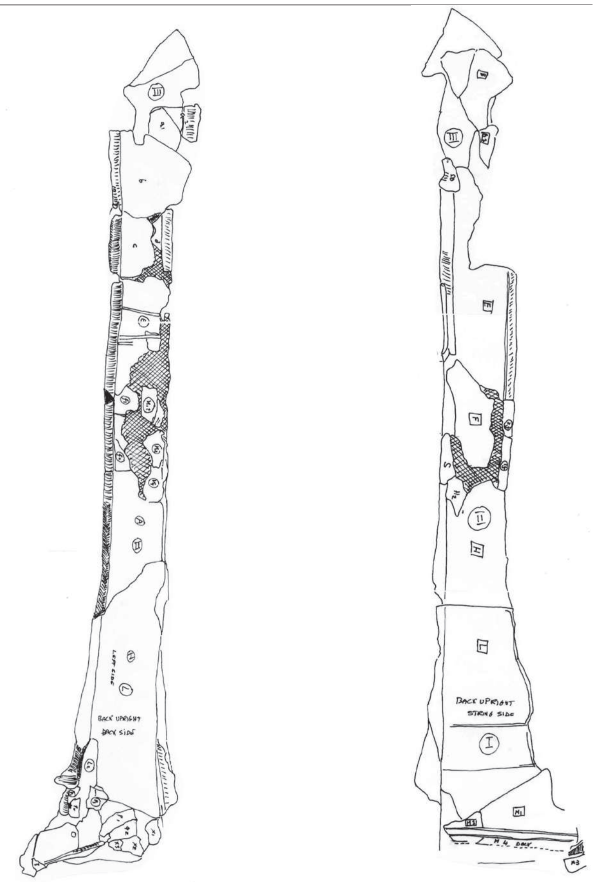


Figure 37. right. sides of tail uprights. BM archive)

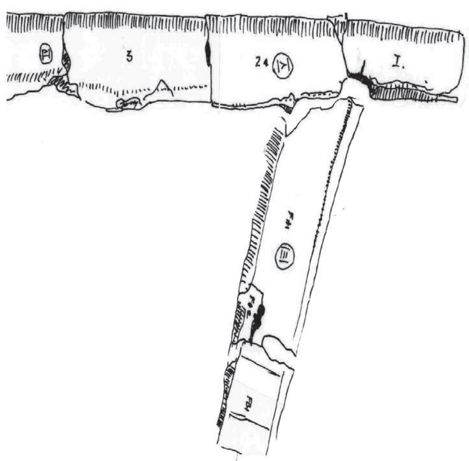


Figure 38. Hypothetical joining of head upright with the yoke. (BM archive)

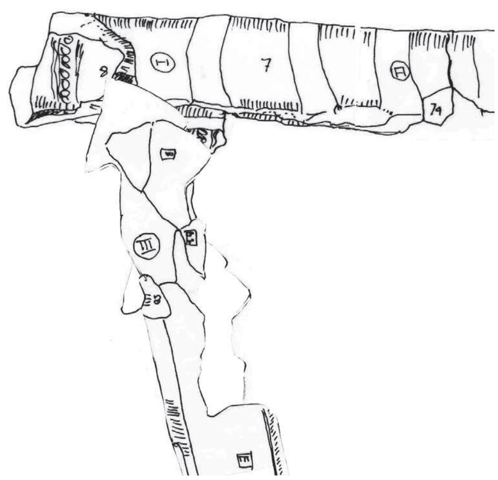


Figure 39. Hypothetical joining of tail upright with yoke. (BM archive)

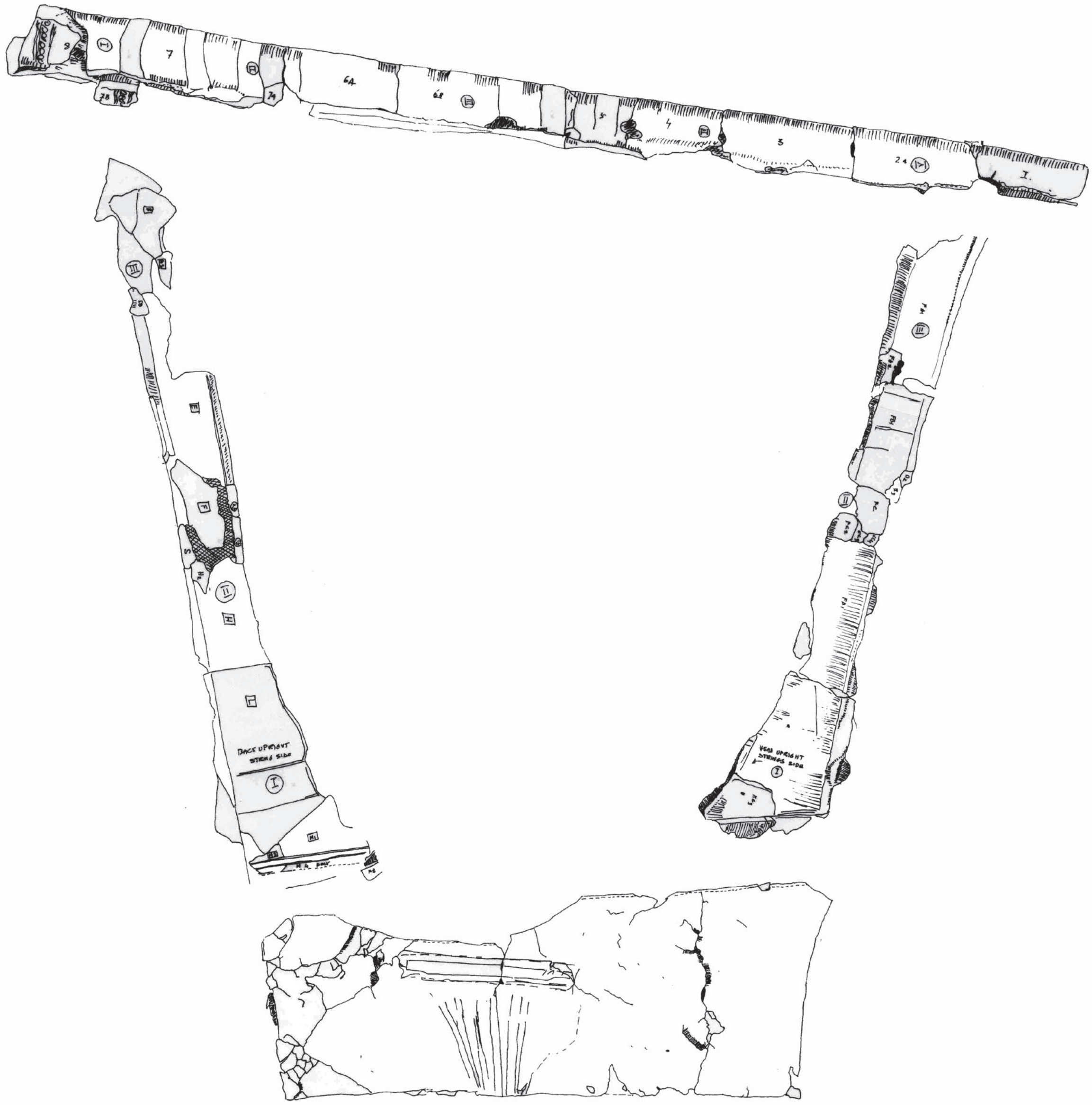


Figure 40. Pre-positioning of string-side soundboard, uprights and yoke. Note the missing tesserae and border. (BM archive)



Figure 41. Pre-positioning of side opposite string-side, uprights and yoke. Note the missing tesserae and border. (BM archive)

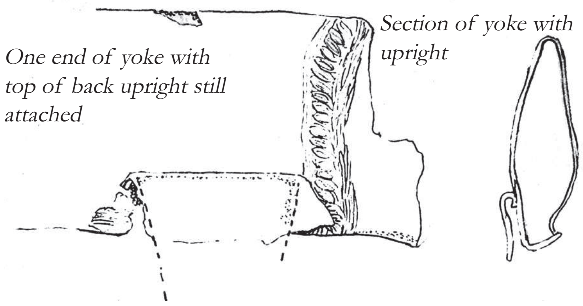


Figure 42. Details of the junction of the yoke to the back upright. (BM archive)

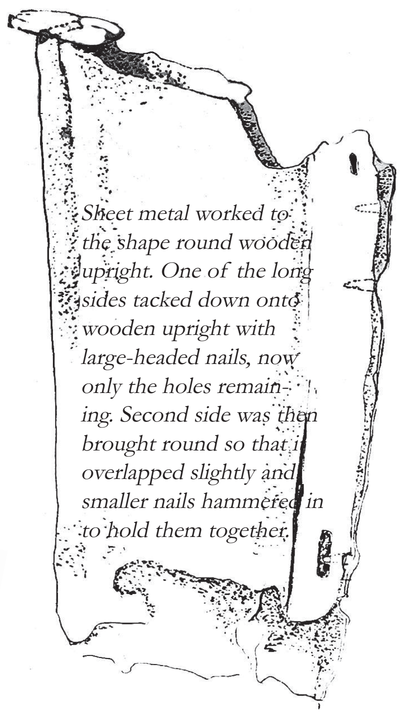


Figure 43. Detail of upright showing the fixation of the silver plate. (BM archive)



Figure 44. Drawing of the groove left at the base of the head upright where the yoke of the Gold Lyre rested. See figs. 13;-16; 21, 22, 35. (BM archive)



Figure 45. Photograph of the head upright of the lyre drawn at figure 44 above. Note that the groove has been restored. Author's photograph.

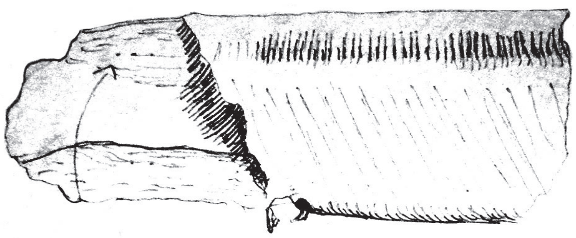


Figure 46, Extremity of the head part of the yoke showing the place where it joins with the front yoke. Profile view.

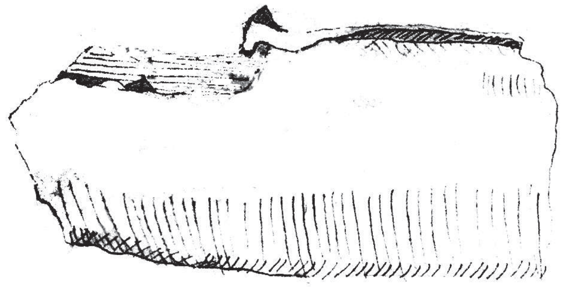


Figure 47. Extremity of the head part of the yoke showing where it joins with the front upright. Opposite view of figure 40 above.

The bridge of the lyre

There are no indications regarding the nature of the bridge that was used on the silver lyre other than an estimated size which was derived from both marking on the soundboard and from the fan-shape of the eleven strings. However, an incised scapula recently discovered at Kinrot[1], Israel, is most likely to be a bridge: The item is made from the edge of the vertebral border of a scapula identified by the authors as originating from a fallow deer. Its length, said to be 79 mm long, is disputable since both extremities are worn and cannot provide accurate measurements. However, the morphology of the item, its size, the material of which it is made, the number of incisions with which it is grooved, do make it possible that it could have belonged to a stringed instrument. Because it could not have fitted a lute, because no such instrument is know to have had seven strings until centuries later, or to a harp since harps have neither bridges nor nuts, all clues suggest that the implement would have been the bridge of a lyre. Ancient near-eastern organology reveals that makers of instruments would use pre-existing materials the shape of which fitting a purpose. In the case of this Iron Age scapula, the vertebral border would have been ideal for the top of the bridge, and its base, where it would have been cut off the rest of the scapula, would have satisfactorily rested on the soundboard. The vertebral border of a scapula is made of strong bone totally appropriate for efficient grooves.

The end button of the lyre

While 'end button' is an appropriate term for the violin, describing where the strings are attached, at the base of the instrument, it is inappropriate to describe the attachment on a boviform lyre. Viewed from the side the instrument represents the profile of a bovid. We have the body, the legs, the head and at the base of the instrument is a protuberance that must intentionally be the penis of the animal. J.P.N. Land[2] in his 1882/3 article 'Recherches sur l'histoire de la gamme arabe' writes: ...*Zobaiba* pourrait être le diminutif de *zobb* (*membrum virile*) et s'appliquer à l'appendice qui se trouvait au bas du corps de l'instrument. (*Zobaiba* might be a diminutive of *zobb* (*membrum virile*) and designate the appendix placed at the base of the body of the instrument.

1 Nimrod Marom, Guy Bar-Oz, Stefan Münger; *Near Eastern Archaeology*, Vol. 69, 2006; Dumbrill, R. Commentary on the New Inscised Scapula from Tel Kinrot, *Near Eastern Archaeology*, Vol. 70, No.1, March 2007.
2 Land, J.P.N, Recherches sur l'histoire de la gamme arabe, *Congrè des Orientalistes,* Leyden, 1882/3? Brill., pp. 36-132.



Figure 48. Detailed photograph showing part of the soundboard, the row of tesserae of lapis lazuli, shell and lapis lazuli, and the border of the soundbox which has been completely reconstructed with glues and silver powder after the original collapsed during the restoration. Author's photograph.



Figure 49. Showing parts of a tuning pin still affixed on the yoke by corrosion. Author's photograph.



Figure 50. Other view of the tuning pin. Author's photograph.



Figure 51. Remains of nine tuning pins showing where tuning tool and strings was inserted. The remains of the two missing tuning pins, there were eleven altogether, are still stuck, corroded to the yoke. (see figures 52 and 53 to the left. Author's photograph.

The figures are self-explanatory and are accurate drawings of the lyre after it had been pulled apart in the early sixties. It will be noted that the border delineating the row of tesserae around the soundbox is not depicted.

The reason is that this part of the instrument collapsed in minuscule fragments which were not worthy of recording. Therefore the width of this border is left to the interpretation of photographs prior to the 1949 collapse.

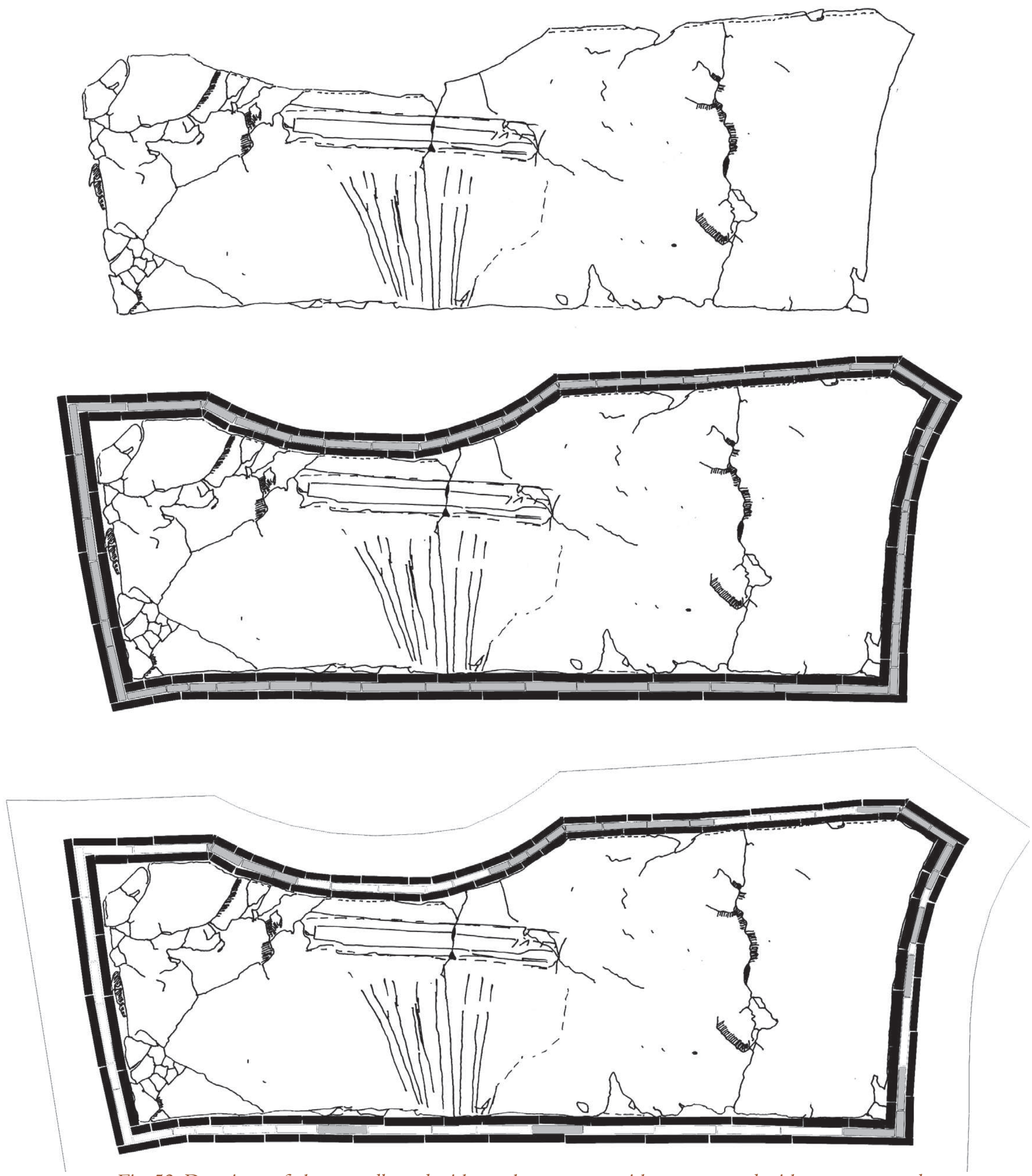


Fig. 52. Drawings of the soundboard without the tesserae, with tesserae and with reconstructed border. (BM archive)

PART III - REPLICATION

Owing to the damage caused during the restoration of the lyre and of the limited amount of organological data – note the abundance of notes about silver consolidation compared to organological reports – an exact replication of the silver lyre was judged inappropriate. Therefore it was agreed that a similar instrument would be built, concentrating on whatever might be learned from the meagre remains available from the original.

Having observed that each extant boviform lyre from the same period has differing measurements, it was assumed that each instrument, if not made by the musician himself, would have been built by different artisans whose primary formation would have been woodwork, with some metal and leather work abilities. There is no Sumerian and Akkadian textual evidence that there were specialised instrument makers at Sumer, or later at Akkad, Babylon or Ashur. On the other hand we have evidence from Mari that materials for the building of musical instruments were ordered by artisans specialised in wood, leather and metalwork and that it is possible to assume that instrument making was part of their training or that they adapted their trade to their making. During the reign of Zimrilim, in the early second millennium B.C. (1779(?)-1757(?)), we have the following attestations in a series of cuneiform texts: 2 *šinnuntum*-hides received by Hammatan for making a throne of Shamash, a dish [...] and things(?) for musicians; 1 *šinnuntum*-hide received by Habdumalik for (making) a table and a *paraḫšitum*-large boviform lyre(?); 1 *šinnuntum*-hide received by Huburabi, for (making) a *šebîtum*-instrument, a *tilmuttum*-instrument, and a *kinnārum*-portable lyre(?); 1/2 a *šinnuntum*-hide received by Didi for (making) two *kinnārum*-portable lyres(?); 2 *šinnuntum*-hides for making a throne of Shamash, a table, a table of Meluhha and for making the *unutūm*-material for the musicians, received by Hammatan; one *šinnuntum*-hide for making a dish and a *paḫašitum*-large boviform lyre(?), received by Habdumalik.[1] These texts further mention 2 hides for the *balaggum*-instruments, for the purification ceremony; alum salts for the tanning(?) of hides for the *alūm*-drum; 120 bronze nails to stretch the hides for 2 *alūm*-drums; *šimtum*-glue received by Milkiaddu for 2 *kinnārum*-portable lyres(?); 1 *qa*-measure of vegetal oil for 5 *alūm*-drum hides; 9 *šinuntum*-hides for

10 artisans thus 5 and a half hides for making musical instruments; there is also mention that one ^{giš}*le'um;* one *urzababītum*-instrument, one *algaršurrum*-instrument, one *sammūm*-harp(?), and one *kinnārum*-portable lyre are gold-plated. So, at Mari, we know that there were some artisans specialised in the making of specific intruments. For instance, Habdumalik made *paraḫšitum*-large boviform lyres(?); Haburabi made *šebîtum, tilmuttum* and *kinnārum*-instruments. Didi and Milkiaddu made *kinnārum*-portable lyres(?). We know that hides were used for most percussion and string instrument types, probably for their soundboards as a drum-head is a soundboard. We know that alum salts were used for their preservation and that vegetal oil was used for their purification at the temple. We are informed of the usage of bronze nails, probably for the stretching of hides onto the frames of instruments and that some of them were gold-plated, or made of gold plates, such was the case, with silver plates, with the silver lyre.



Figure 54. Pu Abi's harp to the left compressed against a silver soundbox showing the overturned lips of the metal. (BM archive)



Figure 55. Other view of the soundbox in figure 54. (BM archive)

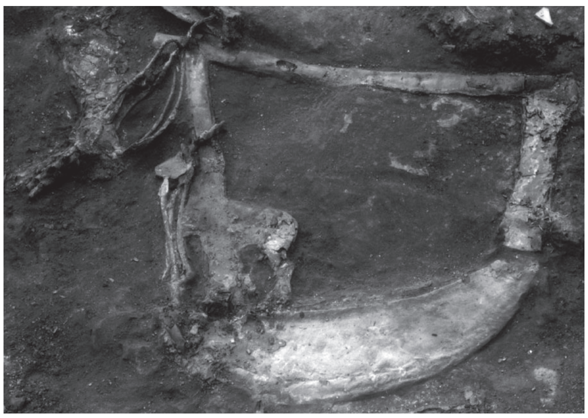


Figure 53. The boat Lyre made from silver plate, U. 12355 from PG/1237. (BM archive)

Of course, this evidence is restricted to a short period during the early second millennium at Mari and does not constitute evidence that either the same techniques, names and functions for these instruments were the same used earlier, at the time, or later outside Mari, but that it constitutes a serious basis for reasonable assumptions to be made in that respect. Would the *paḫašitum* used at Mari, which probably came from Iran as its name might suggest, (*paḫaš = fars)* be the equivalent of the large Sumerian boviform lyre, the silver lyre for which we have no lexical identification in Sumerian, or Akkadian, to this day. Thus the usage of metal plates for the making of instrumental soundboards was not an isolated usage specific to Sumer where we have in addition to the silver lyre other instruments which were also fitted with silver plate soundboards.

It is the speed at which the sound travels in a material which determines its appropriateness as a soundboard, and the faster, the better. The propagation speeds of travelling waves are characteristic of the media in which they travel and are generally not dependent upon the other wave characteristics such as frequency, period, and amplitude. The speed of sound in air and other gases, liquids, and solids is predictable from their density and elastic properties of the media (bulk modulus). In a volume medium the wave speed takes the general form:

$$\mathbf{v} = \sqrt{\frac{\text{elastic property}}{\text{inertial property}}} = \sqrt{\frac{B}{\varrho}} \quad \text{where } B = \text{bulk modulus, and } \varrho = \text{density}$$

This relationship works fairly well for water with tabulated values:

$$\mathbf{v} = \sqrt{\frac{2.2 \times 10^9 \text{ N/m}^2}{1000 \text{ kg/m}^3}} = 1483\text{m/s}$$

This agrees well with the measured speed of sound in water, 1482 m/s at 20°C. The situation with solids is considerably more complicated, with different wave speeds in different directions, in different kinds of geometries, and differences between transverse and longitudinal waves. For example, a general tabulated value for the bulk modulus of steel gives a sound speed for structural steel of:

$$\mathbf{v} = \sqrt{\frac{160 \times 10^9 \text{ N/m}^2}{7860 \text{ kg/m}^3}} = 4512\text{m/s}$$

Comparing to one tabulated example for stainless steel shows wide variation between the speed for longitudinal and transverse waves, with this calculated value somewhere in between.

Calculations for other materials are as follows: iron =5130m/s; aluminium =5100m/s; brass: =4700m/s; copper =3560m/s; gold = 3200m/s. This would give approximately 4000m/s for silver, about 5000m/s for spruce; 3500 for raw hide and 3000 for soft leather. Therefore silver is perfectly suitable for its purpose as a soundboard as the denser the medium, the faster the speed of travel of sound within. Therefore, the fitting of instruments with metallic soundboards is a reasonable proposition, generally, and silver particularly, under the condition that at that period the production of sheet silver was a known technique.

What is more important is the quality of sound amplification which results. In all cases, spruce the best material and this is probably why it has become the favoured medium for most soundboards from Stradivari's violins to Rückers harpsichords, to Bösendorfer and other Fazioli pianos. The materials from which different soundboards are made give instruments their particular characteristics of colour, of timbre. This is what makes them recognisable. The soft leather soundboard of the Ethiopian lyres is certainly more suited to the pastoral than if it were fitted with Alpine *picea alba* and it would assuredly be impossible to conceive a 'Strad' with a raw-hide soundboard.



Figure 56. X-ray of the another instrument showing a metallic infrastructure and the nails which would have secured the plated to the frame of the instrument. (BM archive)

Infrastructure of the lyre

Woolley's measurements give a height of 106 cm by 97 in length and 6.5 at its widest with which after careful observation is correct.

However, after careful examination of the evidence and digital reconstruction, the original instrument and its restoration diverge quite significantly as is shown below:

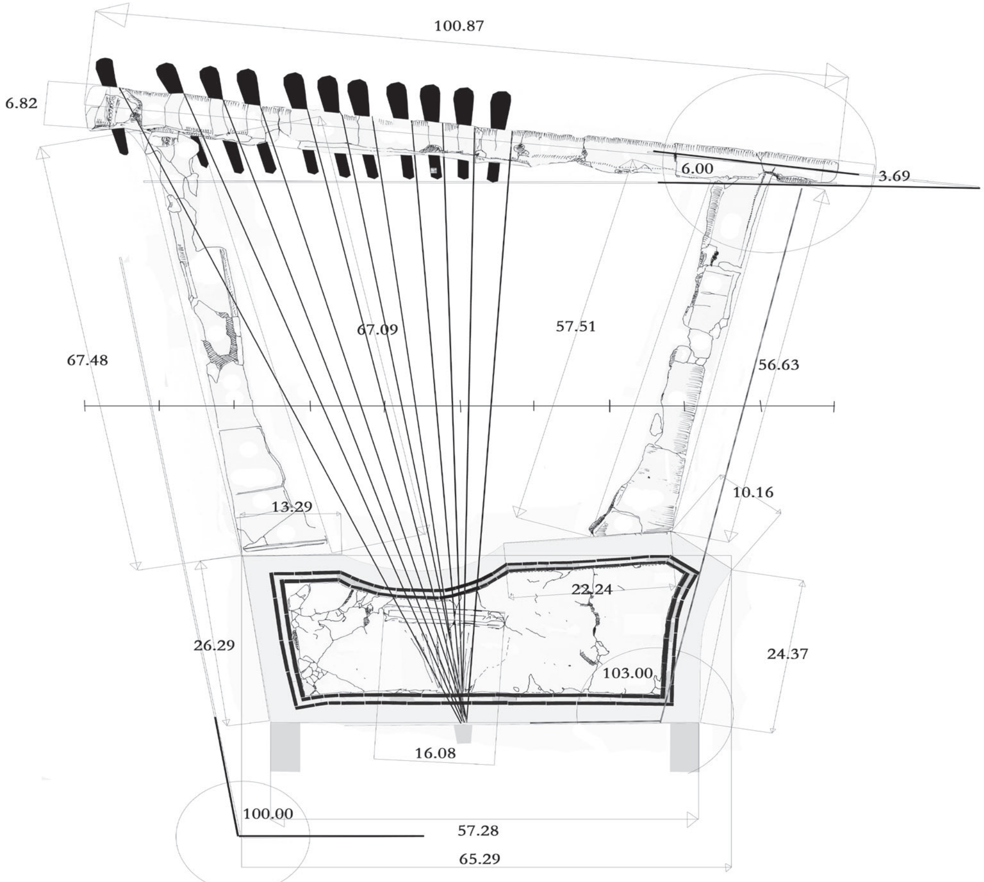


Figure 57. Measurements reconstructed from the evidence of the original archaeological drawings. (BM archive)

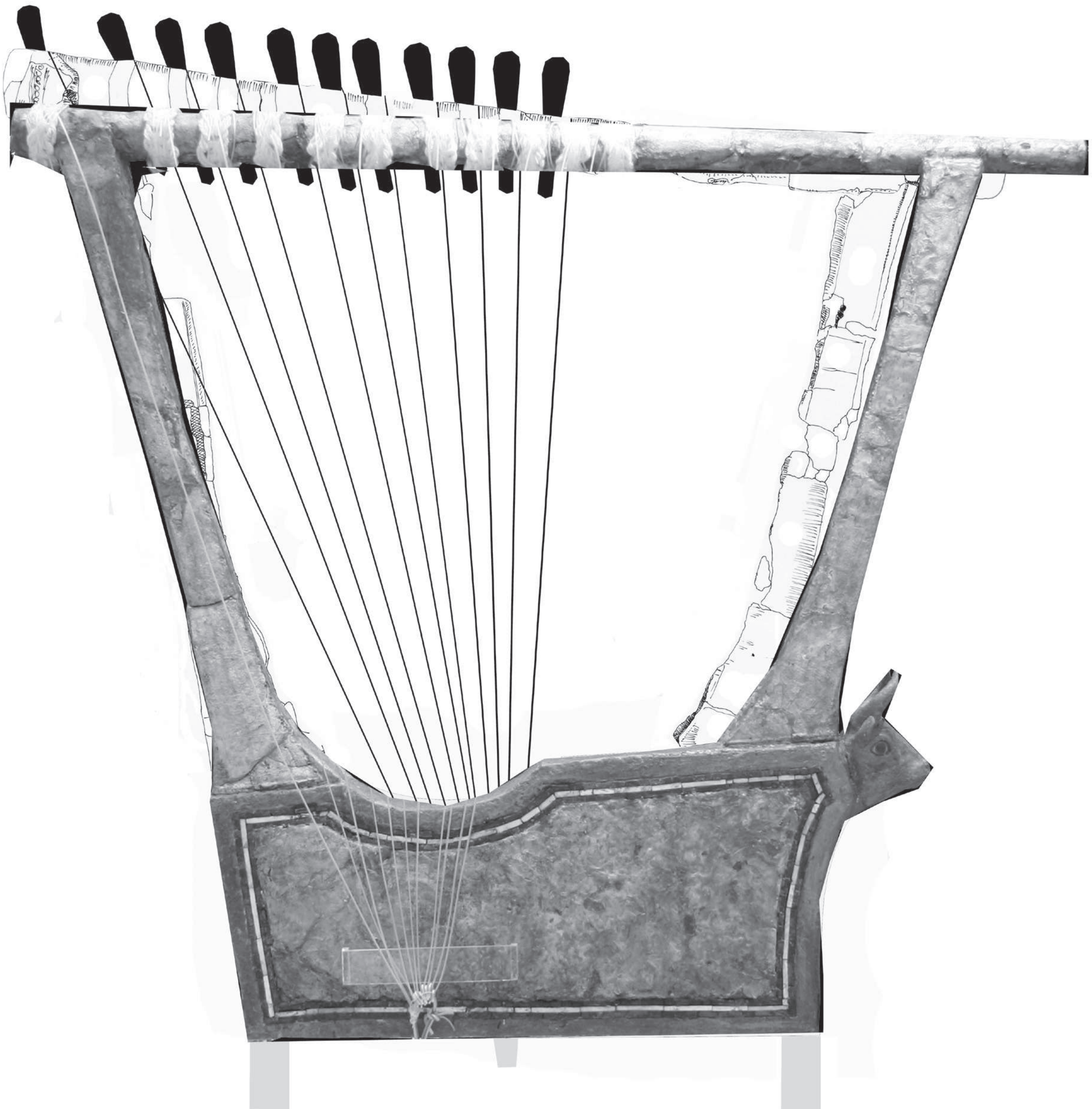


Figure 58. Superimposition of the reconstructed measurements and the restored instrument. (BM archive). It is to be notes that the instrument as restored in the late sixties differs from the measurements taken from the original archives. This is mainly due to the amount of silver which was lost during the restoration.

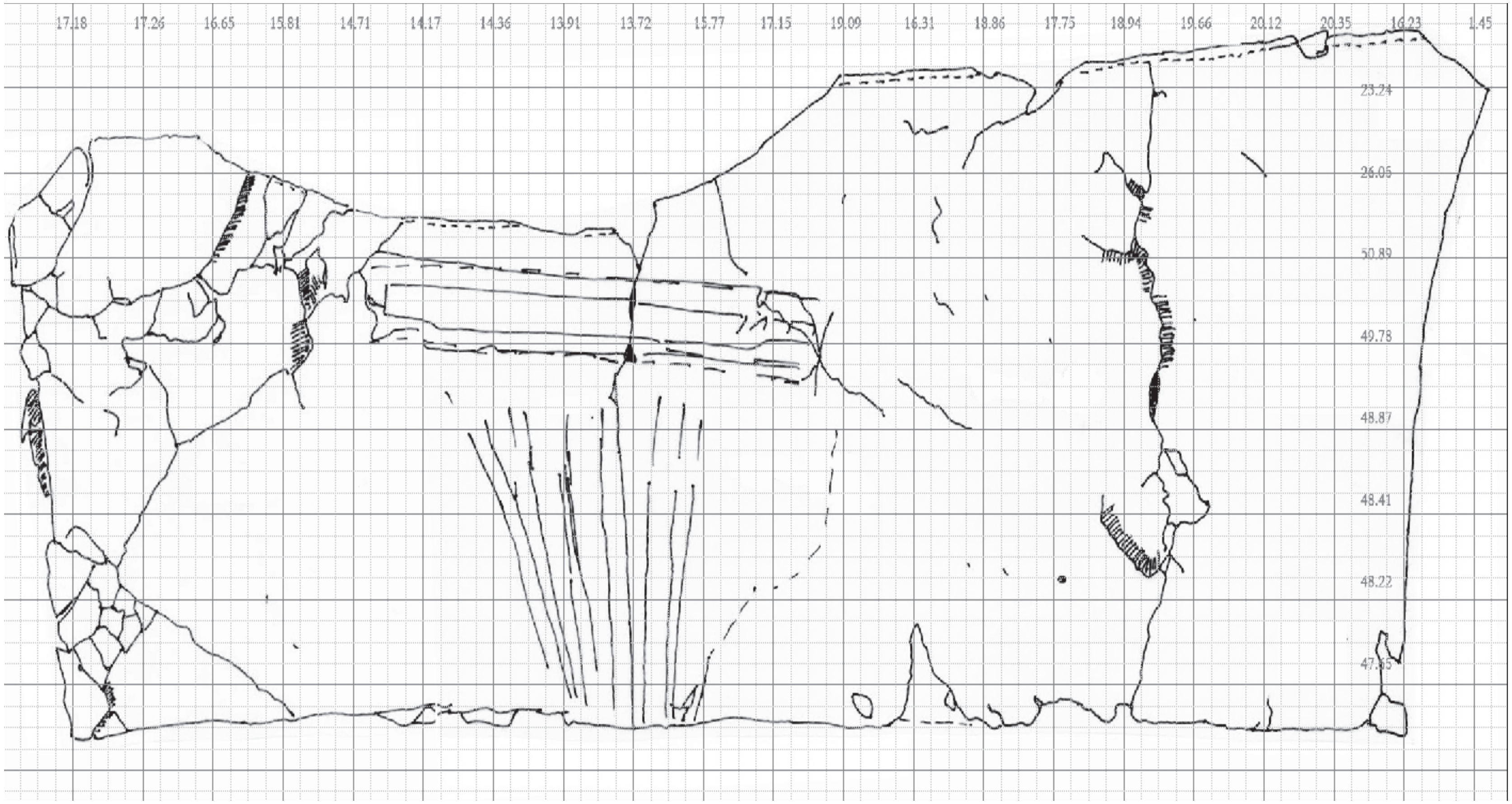


Fig. 59. Measurements of the soundboard. These measurements are very accurate as the bridge and the position of the strings were pressed onto the silver soundboard as it rested face to the reed math which lined the ground of the tomb. It is possible that the bridge shifted higher than where it would have normally stood, as the weight of the soil pressed on the back of the instrument and left a displaced position on the silver. A bridge serves best its purpose of sound transmission to the soundboard when placed, ideally at the acoustic centre of the soundboard. Its current position is therefore not adequate.

Frame, glues, silver, strings, tools and techniques



Figure 60. Sycamore frame for the replication of the silver lyre. Author's photograph.

The frame was made from sycamore *(acer pseudoplatanus)* which is a hard wood well attested in the Ancient Near East. Its grain is tight and is excellent for instrument making. Until the end of the fifteenth century AD, it was used for harpsichord making and was slowly replaced by cypress, an essence also well known in the Mediterranean antiquity. Two types of glues were made. We used casein as there are traces of it used as a primer for painted frescoes since prehistoric times. It is made from curdled milk to which lime is added. It has the quality of being waterproof. We also made bone and hide glue since we know it was used at Mari in the third millennium for instrument and general wood manufacture.

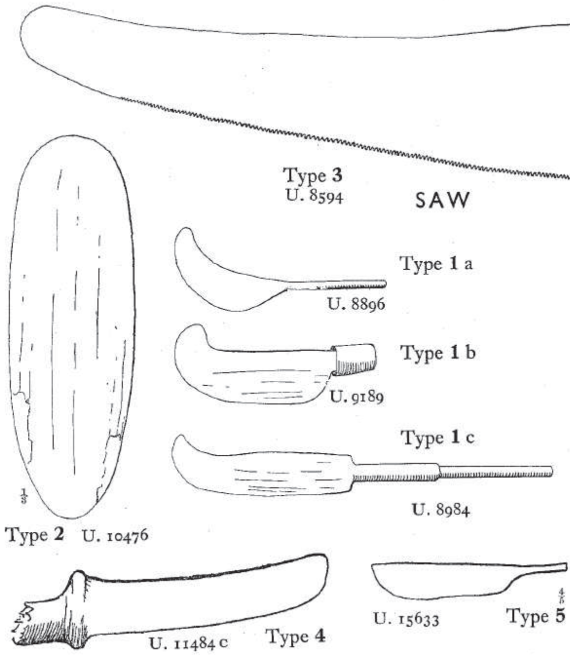


Figure 61. Various saws from Ur graves. Woolley, Ur Excavations, Vol. II, Pl. 229.

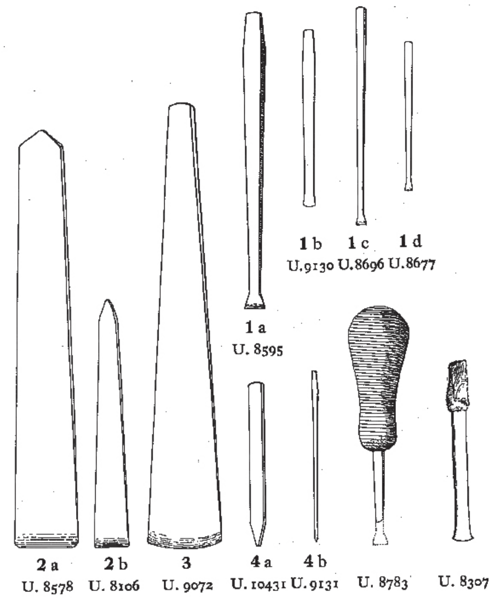


Figure 62. Assortment of chisels excavated at the graves of Ur. Woolley, Ur Excavations, Vol. II, Pl. 229.

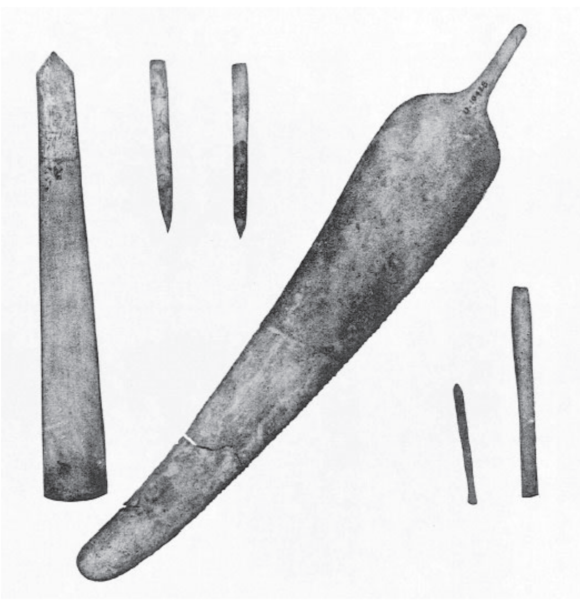


Figure 63. Gold saw and chisels from PU ABI's grave. U.10429; U.10432; U.10431; U.10428; U.10433 and U.10430. From Woolley, Ur Excavations, Vol. II, Pl. 158.

It will be noted that the tenons of both uprights slid into the soundbox down to the bottom of the box and thus were kept in the right position. It is therefore very possible that the uprights were removable for purposes of maintenance but also probably for transport when musicians were displaced from one city-state to the other. The yoke would also have been removable and kept in place by tenon-mortice joints.

During the manufacture of the lyre, only tools contemporary with the instrument were used as their usage was crucial for understanding how things were made. Thankfully many tools had been excavated from the tombs of Ur and replicas were made from these models. There were a variety of saws, each designed for a particular work which reveals that woodworking would have reached a very high standard. Saws made of gold, would obviously have had a symbolic function as the metal is inappropriate for woodwork. Bronze saws would have been adequate. Nails, mainly made of bronze and also of silver would have been used to keep the

joints tightly secured during the gluing process and were probably extracted after, and recycled for later usage. Only silver nails which kept the silver plate onto the lyre were left *in situ*.

The making of the frame was a straight forward operation which did not require more tools than those known from the archaeology. The glues used were satisfactory and appeared to be as good as any modern ones and demanded little time for their preparation. However, the smell of boiling animal hides, hooves and bones was almost emetic. Most of the time was spent on scraping the wood with metal implements to make surfaces smooth and ready for the applying of metal sheets that the laws in England forbade us to call silver since they have not be tested by the Birmingham Assay Office. The bitumen used was slowly melted down until it reached the consistency of custard and then brushed liberally onto the wood. The metal sheets were applied immediately before the bitumen cooled down and hardened. Small nails secured the sheets in place and in case an adjustment was to be made, a flame was brought to the place where the bitumen needed to be softened below the metal.

The soundboard required a large sheet of metal which was shaped with a slight belly to withstand the pressure of the strings, transmitted by the bridge. The metal was gently beaten cold on a slightly convex wooden surface. It was then placed in position within the frame of the soundbox. The sheet was cut to size, hot bitumen brushed onto the soundbox recess, pressed and nailed down all around for perfect fit. A wooden rod was inserted and glued below the soundbox for attachment of the strings.



Figure 64. Positioning of the 'penis' of the lyre.

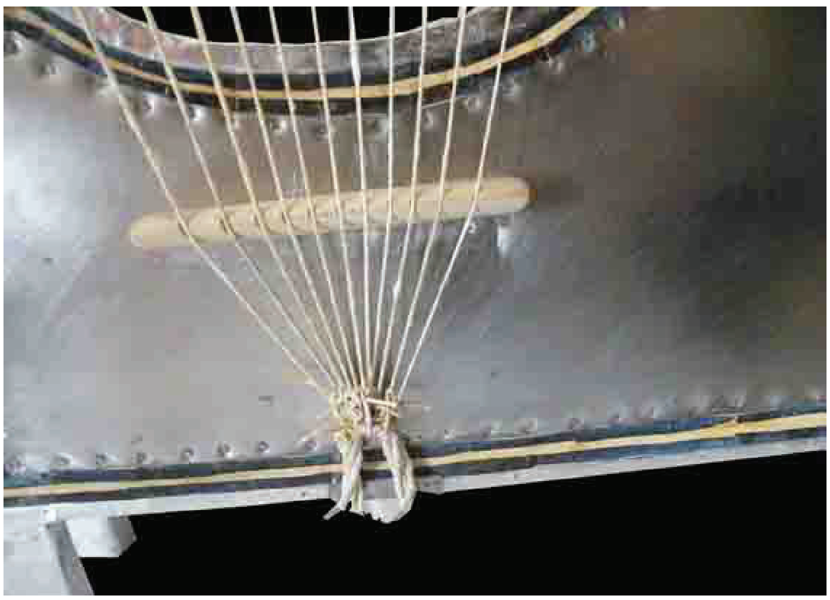


Figure 65. Showing the domed soundboard bitumen-glued to the soundbox and secured with nails; strings attached to the wooden rod below the soundbox, being the penis of the animal; position of the bridge with eleven gut strings.



Figure 66. Positioning and adjustment of the bridge.

It is yet unsafe to say what was the type of bridge used. Some have hypothesised that it would be similar to that of the Ethiopian Bagana although there is no reason why this should be. On the basis of the flimsy evidence of the only extant bridge found at Kinrot, we opted for a traditional bridge made of one solid piece of sycamore carefully fitted to the surface of the soundboard to avoid any buzzing during playing.



Figure 67. Tuning levers in preparation.

The tuning levers, or tuning pegs were also made from sycamore because of its qualities. The sawing was a lengthy process which demanded frequent sharpening of our bronze tools.

The close examination of the original tuning pegs revealed that they were all drilled through at the same places and spaced equally. This led us to the hypothesis that this lyre was not equipped with the usual tuning levers which tensed or relaxed the strings by rotation around the yoke but that differently, they were tightly fixed vertically against the yoke with gut strings. Each string was then driven through the lower hole with its end bit tied in a knot. The upper hole was used for tuning with a metal rod, especially designed to rotate the peg on its axis. This method would certainly be an intermediate transitional phase between the 'tuning lever' and the 'tuning peg' methods.



Figure 68. Tuning pegs in their position.



Figure 69. Lowest string surprisingly placed outside the trapezoidal frame of the lyre.

The position of the bass string was atypical as it was placed outside the trapezoidal frame of the lyre. From this we speculated that originally this silver lyre would have been fitted with nine strings and that in the course of time two strings were added, one at the treble and one at the bass.

The musical theory of the Ancient Near East concords with this hypothesis as texts spanning from the Old Babylonian Period, about 1800 BC, to the Neo-Assyrian Period, about 600 BC, mention enneatonic musical systems to which pentatonic and heptatonic were added in the course of musical developments.

The strings were made of sheep's guts. The term used for them was Sumerian SA, Akkadian *pitnu*. They were washed, then preserved with alum a technique which was well known for Mari and other archives. They were washed again and twisted with a spindle, probably the same that was used for spinning wool or other fibres and then let to dry under the sun. For bass strings, more than one length of gut would have been spun together. Stronger strings such as used for attachment onto the 'penis' of the animal would have needed as many as eight lengths spun together. There is ample evidence from the Mari archives that the making of strings was a speciality as letters dating from the third millennium requested that some should be ordered as soon as possible, from another city. Obviously, there were places where their manufacture was better than others. We have experimented with gut string making for over thirty years, mainly with sheep and pig, but also with various birds such as chicken, geese and duck. It is contended that the guts used for lyres were those of from the totemised animal. A bull lyre would have been strung with bull guts, a fallow deer lyre would have been strung with fallow deer guts, and so on.

Mainly, soundboards too would have been made from the raw hide of the animal it represented. The case of the silver lyres of Ur is quite unique. No other archaeological sites of the Ancient Near East has to this day revealed comparable examples.

The silver calf's head was executed by John Dean, a renowned artist from London exhibiting internationally and teaching at the Heatherley School of Arts in Chelsea, London.



Figure 70a . John Dean's silver calf head, side view.



Figure 70b. John Dean's silver calf head, front view.

PART IV - MUSICOLOGY

The Musicological Setting

At the end of the fourth and during the third millennium BC, large zoomorphic lyres were prominent. They appeared at royal courts and in religious contexts in the iconography as well as with inscribed cuneiform clay tablets. Most of the string instruments listed along with their players, and the songs they accompanied, in the third millennium BC are represented by the Sumerian sign balag̃ or compounds of it. It would therefore be reasonable to assume that the boviform lyres would have been called balag̃s unless the sign represented a general term for stringed instruments.

However, 'balag̃' is not a Sumerian word. There is Arabic *balagh* a term which implies tension, as in the tension of a string, and we find a 'bolong' in the Guinea Conakry which strikingly resembles two particular Elamite instruments, and one from neighbouring Southern Iraq, as both types are string, percussion and idiophonic at the same time. This particularity might be the explanation for the sign representing string and percussion at different times and at differing places. Lyrists would have played to accompany their songs and therefore the sounds of their instruments would have been the replication of the sounds of their voice. It would be inconceivable that they differed.

Lyres fitted with a greater number of strings would have become paradigms and it appears from texts of theory that the number of nine strings was the favoured span.

Texts of Theory

No texts of musical theory from the period at which the Silver Lyre of Ur was made and played have survived, as far as we know. However, there is evidence from later texts that parts of the theory dating from the early days of the third millennium might have survived as copies. These were duplicated up to the middle of the first millennium BC and probably found their way into Greek music theory during the Orientalising period. It was during that period that scholars from the Hellenic world milked knowledge from Babylon which was at that time the centre of universal knowledge, in all fields. We have evidence that Plato's number in his *Republic*, book VIII, found its origins from autographic clay tablets, indubitably dated from 2300 BC, excavated at the Temple Library of Nippur. These mathematical tables were composed almost 1500 year before Plato could read, let alone write. Greek theoreticians never mentioned their sources and the scientific world

was satisfied that all came from Ancient Greece.

When the cuneiform script was finally deciphered, towards the end the nineteenth century, it was too late for the hellenists to amend thousands of books written in the course of the past millennium. Most refused to acknowledge that the Greeks inherited it all from the Babylonians and this is how today a Hellenic conspiracy still obnubilates scholarship, universally.

We have said above that no cuneiform texts of musical theory have survived. However, among the tablets from the Temple Library of Nippur, that we mentioned before, are mathematical tables. Four texts provide with regular numbers extracted from the sexagesimal counting system. These numbers are the multiples of the sides of the right angle triangle, erroneously called 'Pythagorean'. These regular numbers are mathematical quantification of all the pitches of the Sumerian/Babylonian musical system expressed in just intervals, a sequence of pitches which Pythagoras and his followers never understood, obviously, as if they had, then Greek theory would have been different from what it is, or from what it claims to be.

The most important cuneiform texts of music theory are UET VII 126; UET VII 74; CBS 10996 and CBS 1766.

UET VII 126 is in the Iraqi museum, Baghdad. It is a bilingual text dating from around 800-700 BC, but it would have been the copy of a much older treatise on account of the Sumerian terms which it includes. This text mentions nine strings which are given in a palindromic order that we find much later in Greece, with seven strings.

UET VII 74 dates for the Old Babylonian Period, about 1800 BC. This remarkable text gives instruction for the construction of scales with nine degrees, amounting to a musical system of nine scales.

CBS 10996 names a series of seven fifths and seven thirds corresponding to the *ajnas* and '*uqud* of the Arabian Maqam System.

CBS 1766 has a heptagramme defining the seven pitches of the heptatonic system. It is the first occurrence of this construction which however, is still attributed to Greek scholarship. Recently, I published another text, YBC 11381 which conclusively proves my previous hypotheses that there were nine different scales of nine pitches.

It is not the purpose of this book to explore the complexities of Sumerian/Babylonian music theory. A comprehensive bibliography is provided at the end of this book for further study.

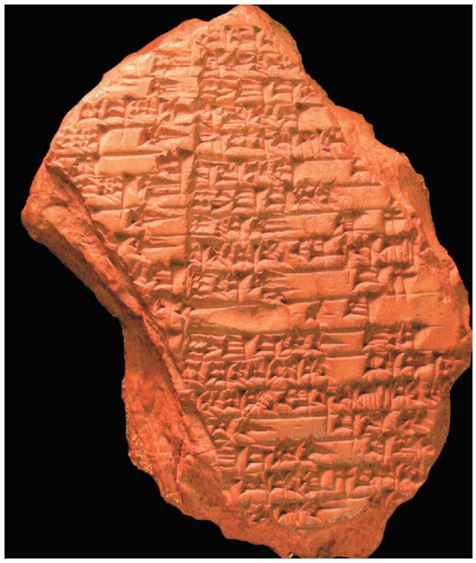


Figure 71. Plaster cast of UET VII, 74. The original is in the Iraqi Museum, Baghdad.



Figure 72. CBS 1766, in the University Museum of Philadelphia

PART V - ARCHIVES

Documentation relating to the Lyres of Ur

I- Woolley's photographic and graphic archives



Figure 73. The author and Museum Technician Gerry Baker removing the Silver Lyre of Ur for close examination.

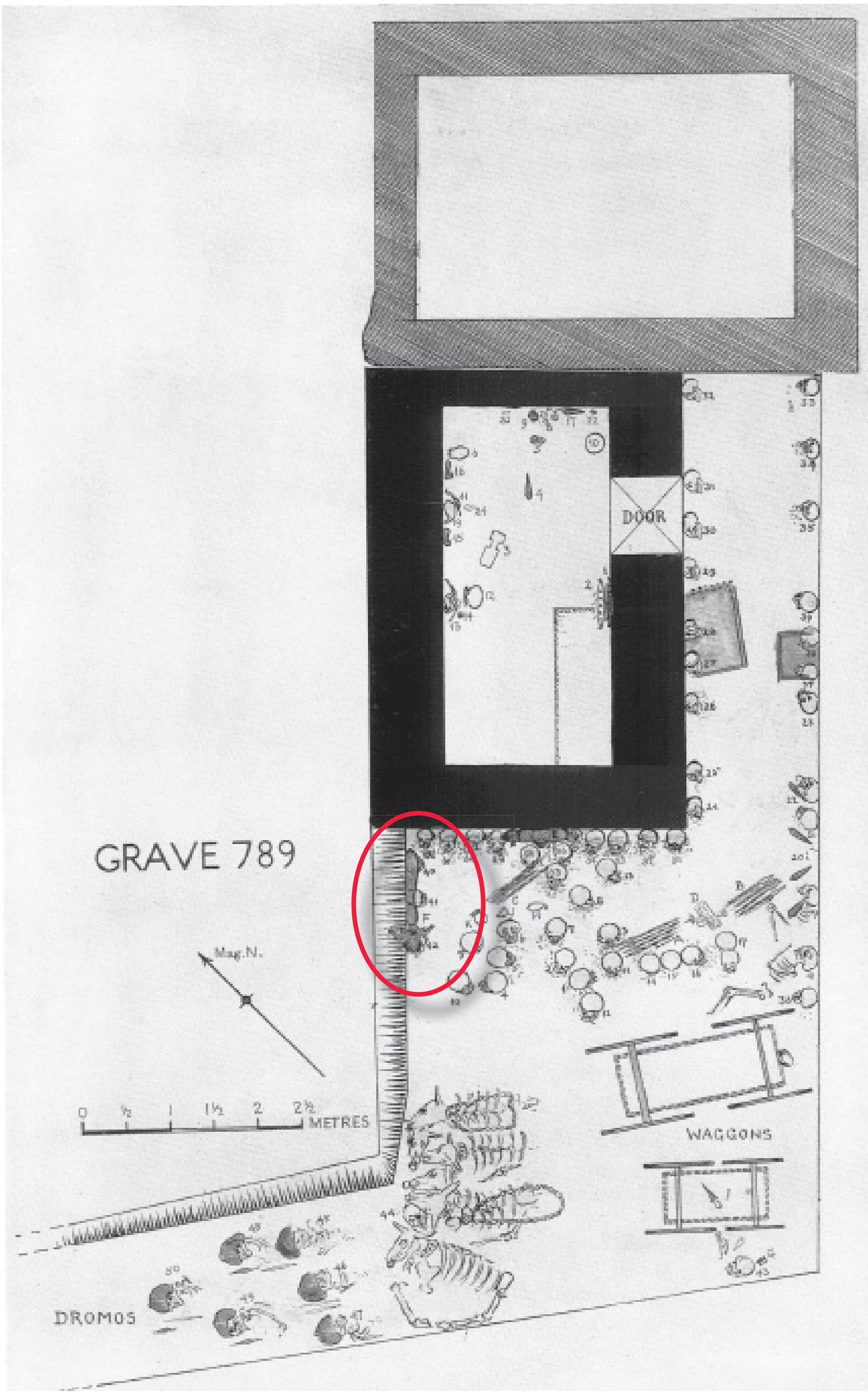


Figure 74. Ground-plan of Private Grave 789 showing the position of a lyre. Woolley, Ur Excavations, Vol. II, Pl. 29



Figure 75. Private Grave 1237. In the foreground the ruined figures of two stags belonging to a silver lyre. U.12356. Woolley, Ur Excavations, Vol. II, Pl. 75.



Figure 76. Two lyres as excavated in position. Woolley, Ur Excavations, Vol. II, Pl. 76.



Figure 77. Engraved shell plaque from a lyre. U.10577. Woolley, Ur Excavations, Vol. II, Pl. 104.



Figure 78. Engraved shell plaque from a lyre. U.10412. Woolley, Ur Excavations, Vol. II, Pl. 104.



Figure 79. Engraved shell plaques from a lyre. U.12554. Woolley, Ur Excavations, Vol. II, Pl. 104

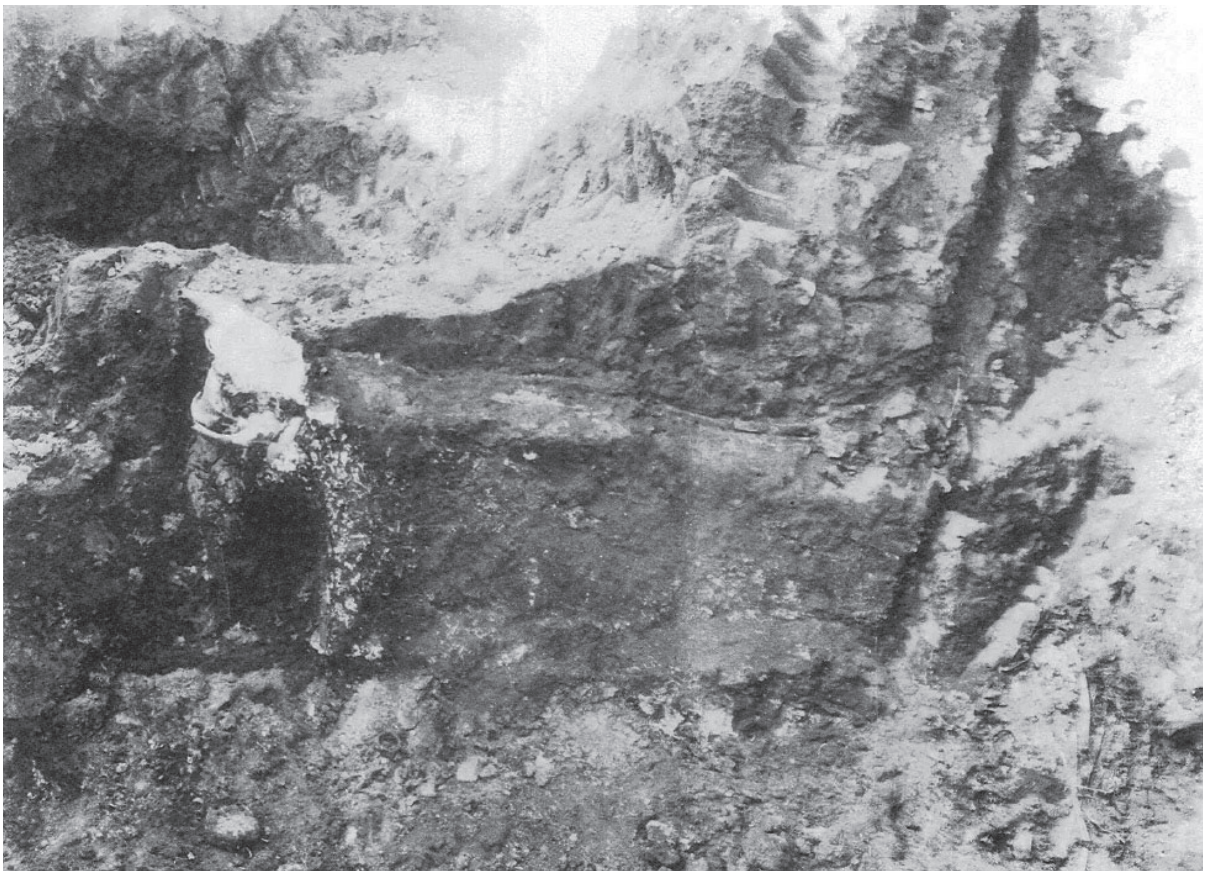


Figure 80. From Private Grave 789. A Lyre in situ showing the impression in the soil of the soundbox and of the back upright. Woolley, Ur Excavations, Vol. II, Pl. 106.

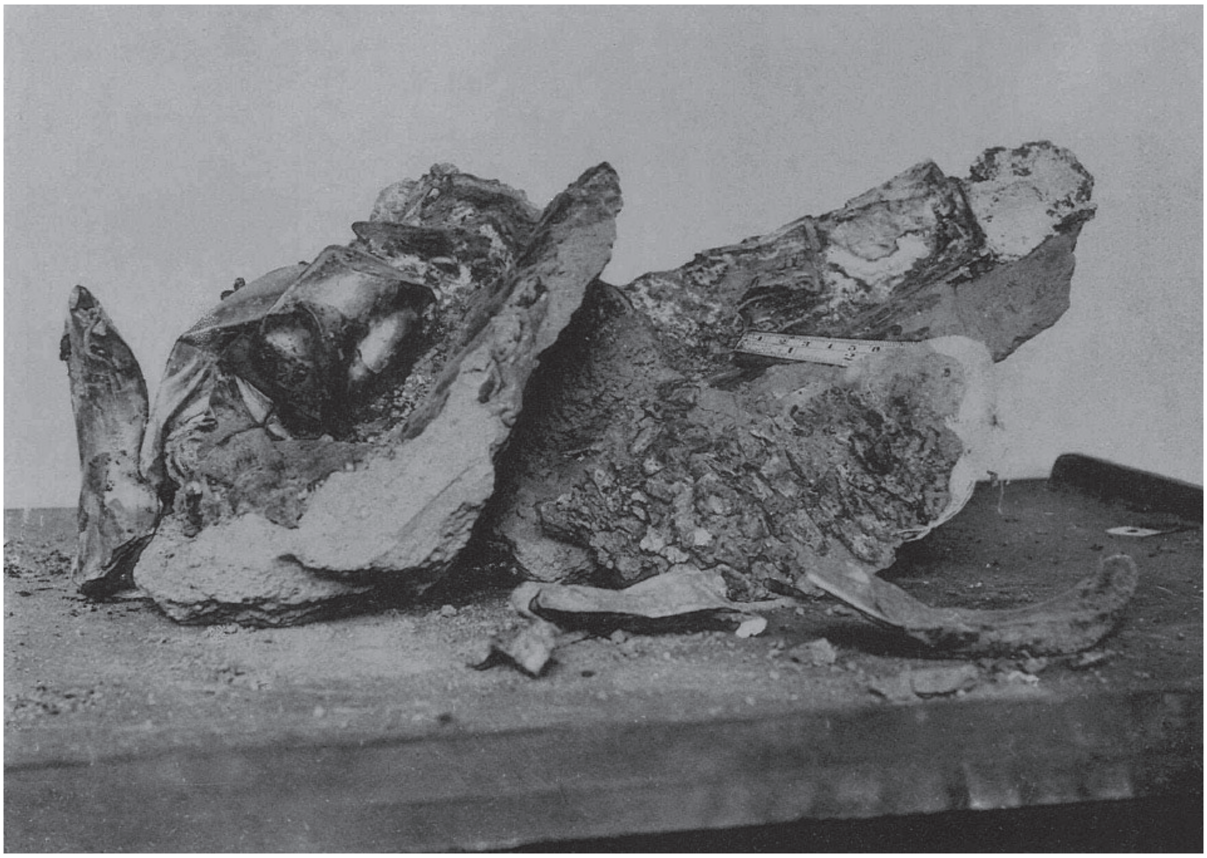


Figure 81. The front of the previous lyre removed for cleaning, U.10556. Woolley, Ur Excavations, Vol. II, Pl. 106.



Figure 82. U.10556. The gold head of a bull with lapis lazuli beard from the soundbox of the previous lyre in Private Grave 789. The lyre is now in the Iraqi Museu in Baghdad. Woolley, Ur Excavations, Vol. II, Pl. 107.



Figure 83. From Private Grave 800. Front of the soundbox of PU ABI's lyre. Woolley, Ur Excavations, Vol. II, Pl. 108.



Figure 84. U.10412. The front of the lyre, restored. Woolley, Ur Excavations, Vol. II, Pl. 108.



Figure 85. U,12355. Silver stag lyre from Private Grave 1237. Woolley, Ur Excavations, Vol. II, Pl. 112.



Figure 86. U.12353. Mosaic border. Woolley, Ur Excavations, Vol. II, Pl. 113.



Figure 87. U.12353. The Gold Lyre from the Great Death Pit, Private grave 1237. Woolley, Ur Excavations, Vol. II, Pl.114.



Figure 88. U.12353. The Golden Bull Head from the previous lyre in Private Grave 1237. Woolley, Ur Excavations, Vol. II, Pl. 115.



Figure 89. U.12435. Copper head from the lyre in Private Grave 1332. Woolley, Ur Excavations, Vol. II, Pl. 116.



Figure 90. U.12435. Shell plaques from the lyre in Private Grave 1332. Woolley, Ur Excavations, Vol. II, Pl. 116.



Figure 91. U.12435. From Private Grave 1232. Woolley, Ur Excavations, Vol. II, Pl. 117.



Figure 92. U.12353. Gold head of a bull from the lyre in Private Grave 1237. Woolley, Ur Excavations, Vol. II, Pl. 117.



Figure 93. U. 12351, from Private Grave 1151. Plaster cast of the wooden lyre in situ after it had been cut away on one side. The white lines of the strings are clearly visible. The third uptight does not belong to the lyre. Woolley, Ur Excavations, Vol. II, Pl. 118.

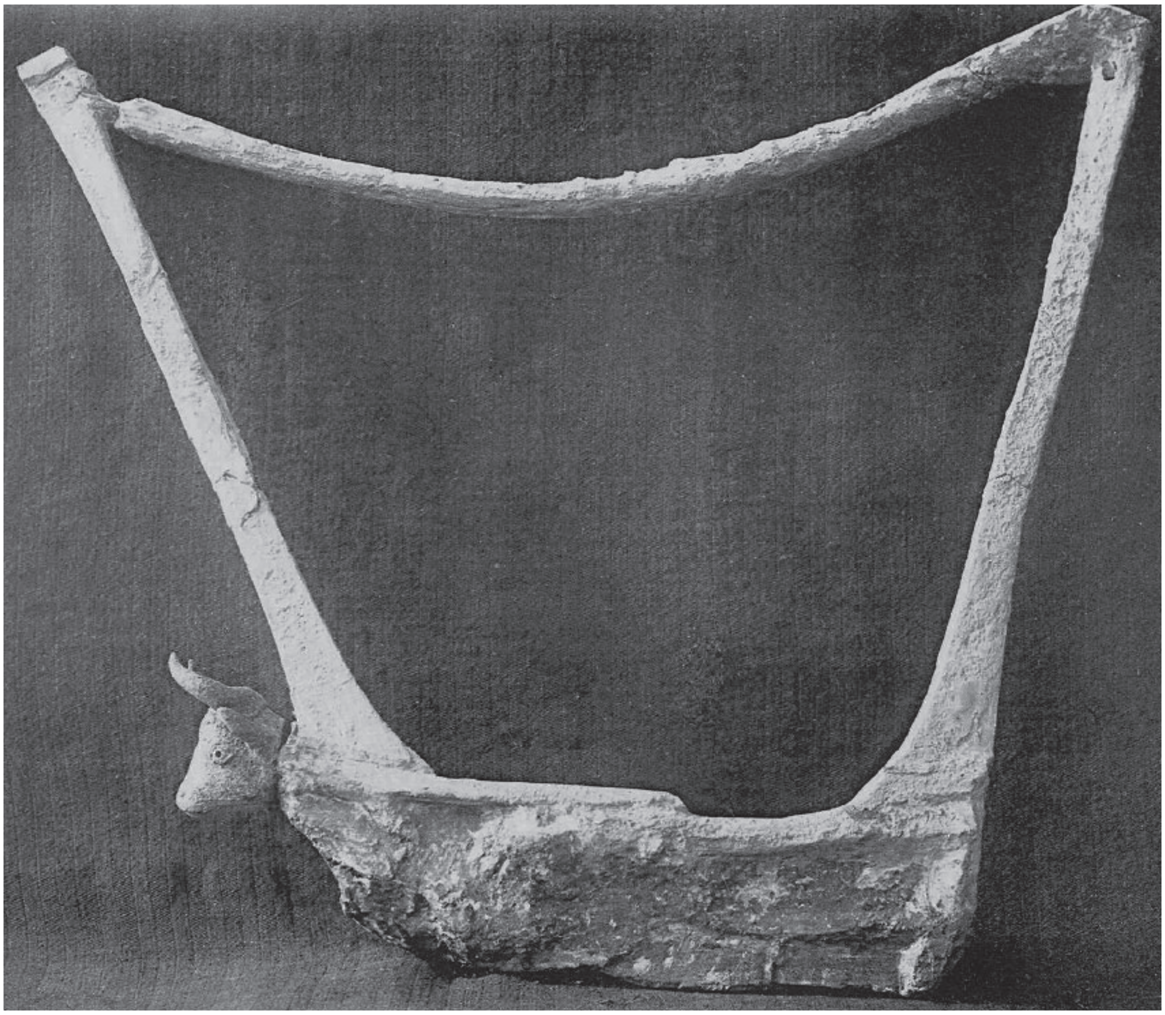


Figure 94. The plaster cast of the lyre removed from the soil. Woolley, Ur Excavations, Vol. II, Pl. 118.



Figure 95. U.12351. The copper bull head of the 'plaster' lyre. Woolley, Ur Excavations, Vol. II, Pl. 119.

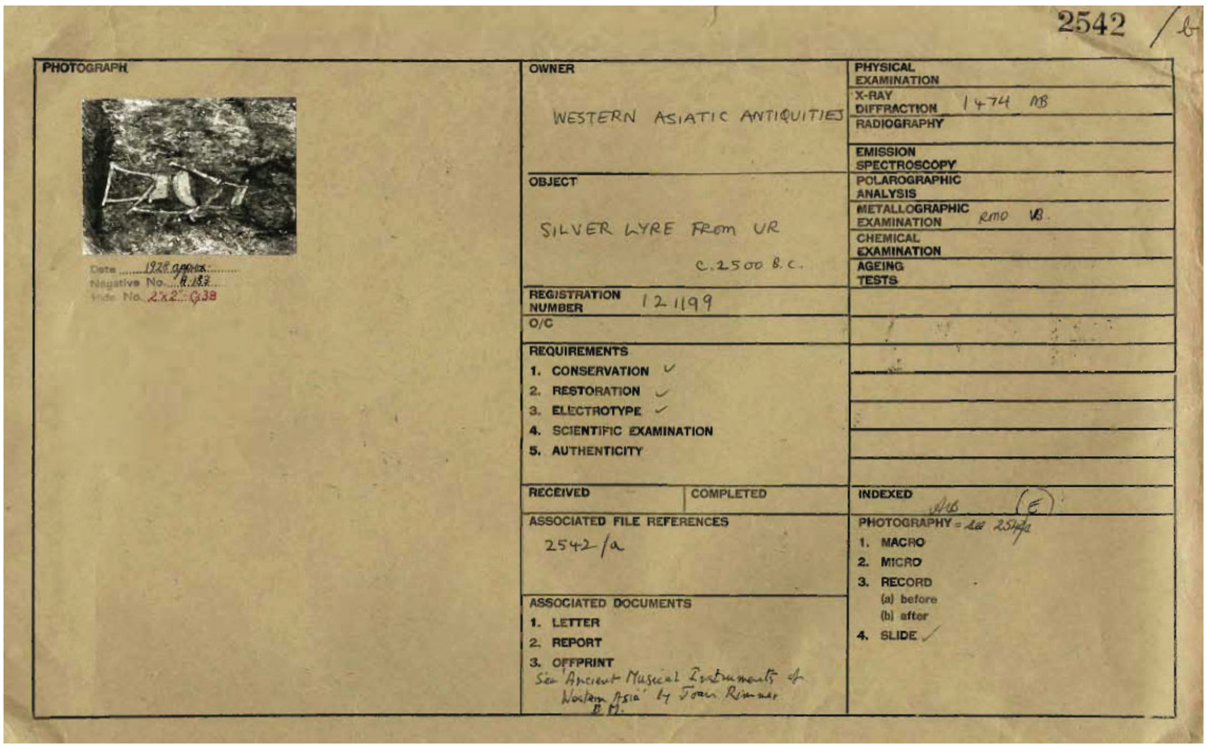


Figure 96. U.10916. Silver cow head from Private Grave 800. Woolley, Ur Excavations, Vol. II, Pl. 120



Figure 97. U.10577. Copper Bull Head from Private Grave 789. Woolley, Ur Excavations, Vol. II, Pl. 120.

Documentation relating to the Lyres of Ur
II- Conservation archive



2542 /b

PHOTOGRAPH

Date 1928 approx.
Negative No. R.182
Slide No. 2"x2" G38

OWNER
WESTERN ASIATIC ANTIQUITIES

OBJECT
SILVER LYRE FROM UR
c.2500 B.C.

REGISTRATION NUMBER 121199

O/C

REQUIREMENTS
1. CONSERVATION ✓
2. RESTORATION ✓
3. ELECTROTYPE ✓
4. SCIENTIFIC EXAMINATION
5. AUTHENTICITY

RECEIVED | COMPLETED

ASSOCIATED FILE REFERENCES
2542/a

ASSOCIATED DOCUMENTS
1. LETTER
2. REPORT
3. OFFPRINT
See 'Ancient Musical Instruments of Western Asia' by Joan Rimmer B.M.

PHYSICAL EXAMINATION
X-RAY DIFFRACTION 1474 MB
RADIOGRAPHY
EMISSION SPECTROSCOPY
POLAROGRAPHIC ANALYSIS
METALLOGRAPHIC EXAMINATION RMO VB.
CHEMICAL EXAMINATION
AGEING TESTS

INDEXED (E)

PHOTOGRAPHY = see 2542/a
1. MACRO
2. MICRO
3. RECORD
(a) before
(b) after
4. SLIDE ✓

Figure 98. Document requesting X-ray diffraction and metallographic examination of the silver lyre.

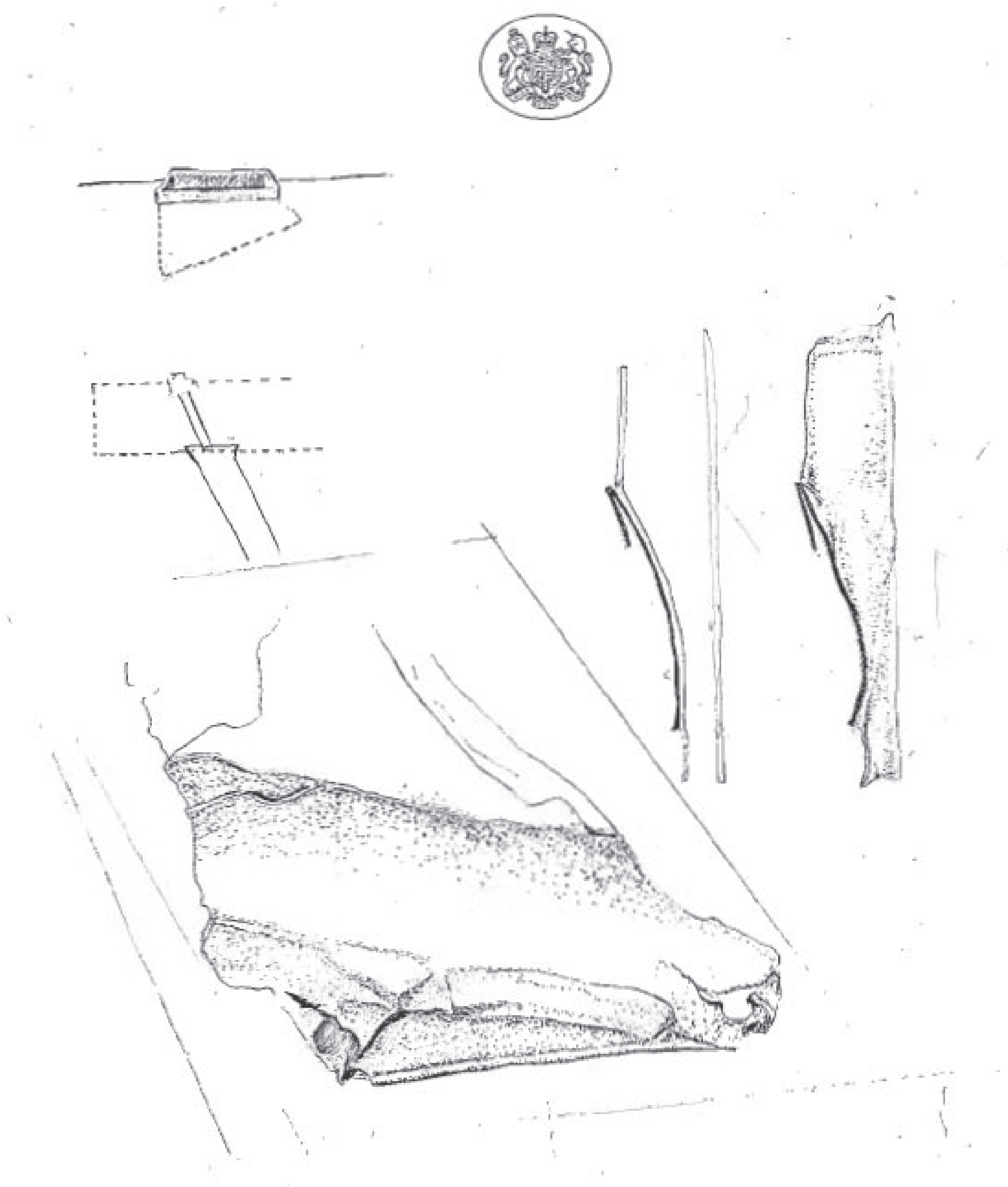


Figure 99. Original drawings of the front upright showing where the yoke of the golden lyre marked its imprint for four and a half thousand years.

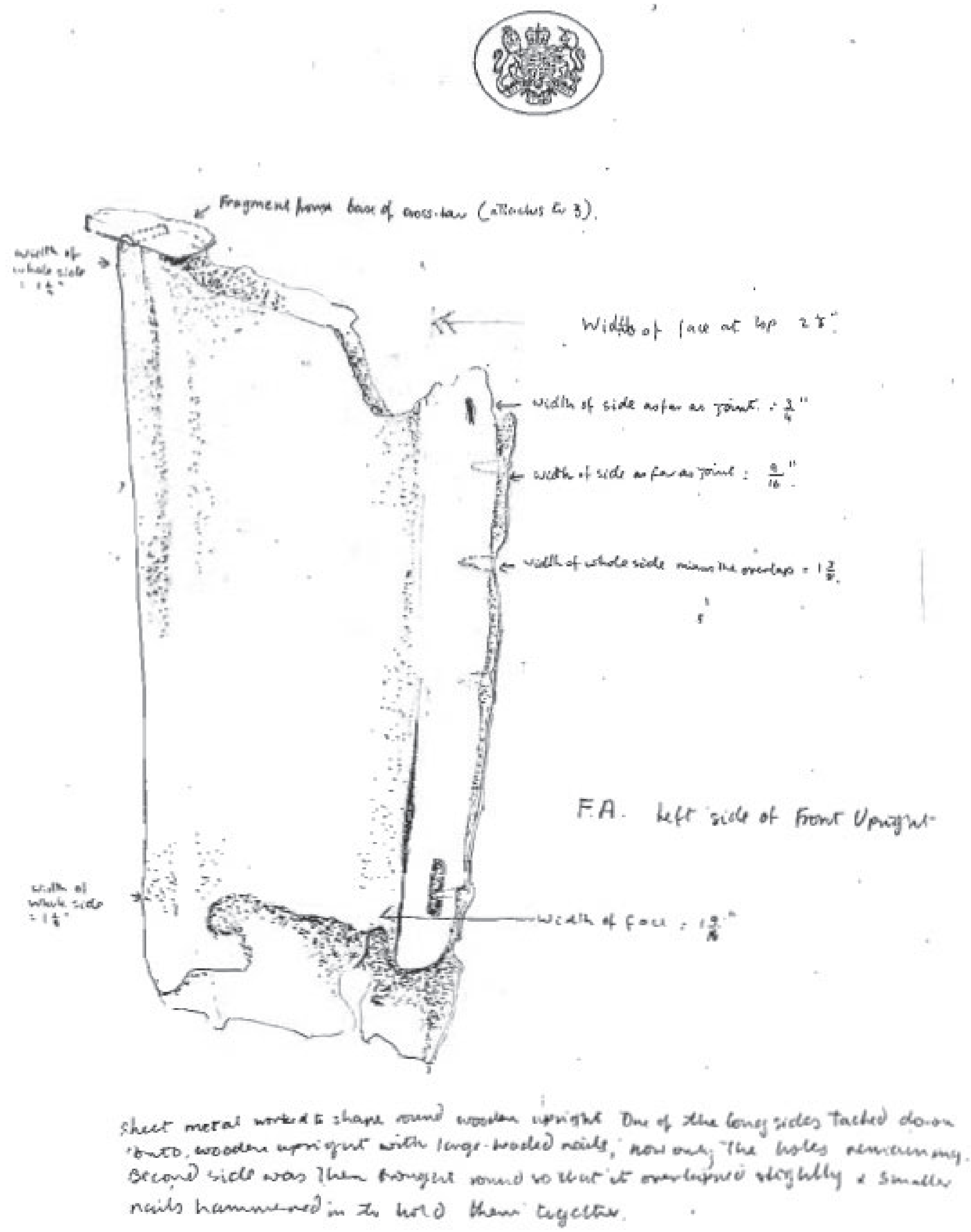


Figure 100. Original drawings of the left side of front upright.

Reduction of AgCl from the Ur Lyre using NaOH as an electrolyte

①. Paraffin wax is removed from the AgCl with Toluene.

②. The AgCl is soaked in 30% H.COOH for 24 hours or until bubbles cease to rise. This will dissolve some of the calcium carbonate and copper salts present.

③. Silver (or tinned copper wire) is laid along the back of the fragment of AgCl. This wire acts as a suspension wire & projects beyond the fragment at one end. If the wire is first annealed in a flame to soften it much closer contact can be made with the AgCl.

④. A layer of Tensol No 7 is applied to the back of the AgCl. This supports the fragment which becomes very brittle after reduction, and also insulates the wire from the electrolyte. Complete insulation of the wire is necessary so that hydrogen is generated only at the surface of the silver. The free end of the wire where it comes in contact with the electrolyte is protected by a P.V.C. sleeve, inserted into the liquid Tensol.

⑤. Electrolyte : 3% sol NaOH. (30gms NaOH / litre distilled water. Strength of solution not critical as long as it is kept dilute. This makes it easier to wash out afterwards.

Anode : Carbon rod. This should be placed in a porous pot or a porous polythene sleeve if possible so that too much carbon does not diffuse out into the solution. Even then fresh solutions have to be made up fairly regularly throughout treatment. The suspension wire of the anode must be kept above the level of the [illegible] (between wire and [illegible]

Figure 101. R.M. Organ's notes on consolidative silver reduction.

6. The silver is removed from the solution when the area of reduced silver (matt-white in colour) have spread throughout whole of fragment & there are no further patches of purple AgCl. Bubbles of hydrogen begin to rise from the surface of the silver when reduction is completed and if the fragment is not removed these bubbles tend to loosen the outer corrosion layer.

7. The reduced silver is washed free of alkali in changes of distilled water. Unfortunately Tensol cannot stand much heat after prolonged soaking in NaOH. Even a temperature of 50°C tends to turn the Tensol milky-white in colour & results in more pronounced shrinkage when the fragment is dried. It is safer not to heat but to change the wash-water at least once a day for about 3 weeks. By this time the conductivity is usually below 10x. Occasionally a slightly higher equilibrium is reached. It is no use then soaking the silver as the conductivity will always rise because of the Tensol backing.

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anode is the one most responsible for loss of electrical contact & must be kept very clean. Alternatively use a crocodile or bulldog clip.

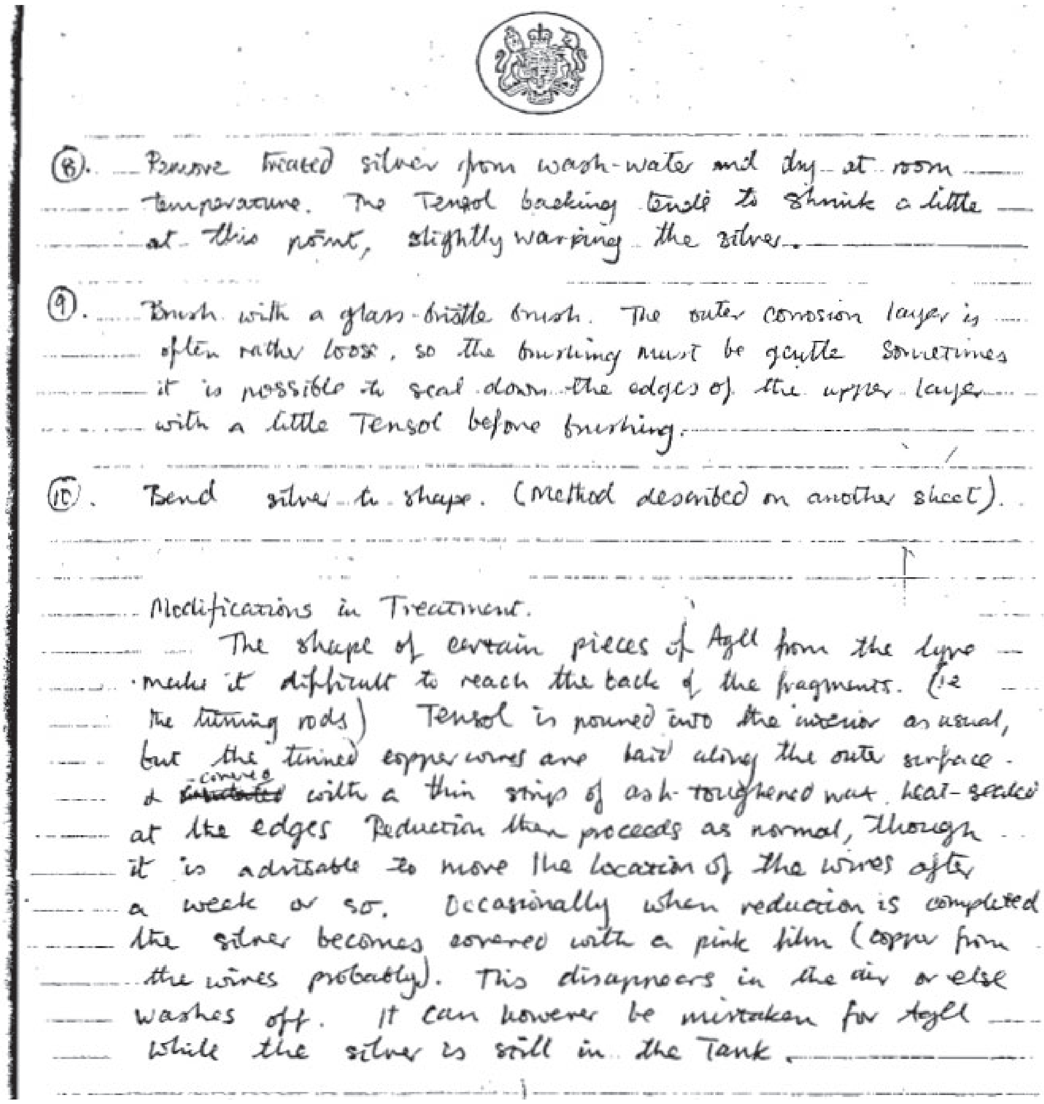
Length of reduction: 3–4 weeks on an average.

Current Density: 10 mA/dm² (i.e if exposed surface of AgCl is 20 cm², the current used will be 2 mA)

Type of current: Partially rectified. This helps to consolidate the silver.

Cathode – The AgCl is placed in the beaker with its exposed surface facing the anode(s)

Figure 102. R.M. Organ's notes on consolidative silver reduction, continued.



(8). Remove treated silver from wash-water and dry at room temperature. The Tensol backing tends to shrink a little at this point, slightly warping the silver.

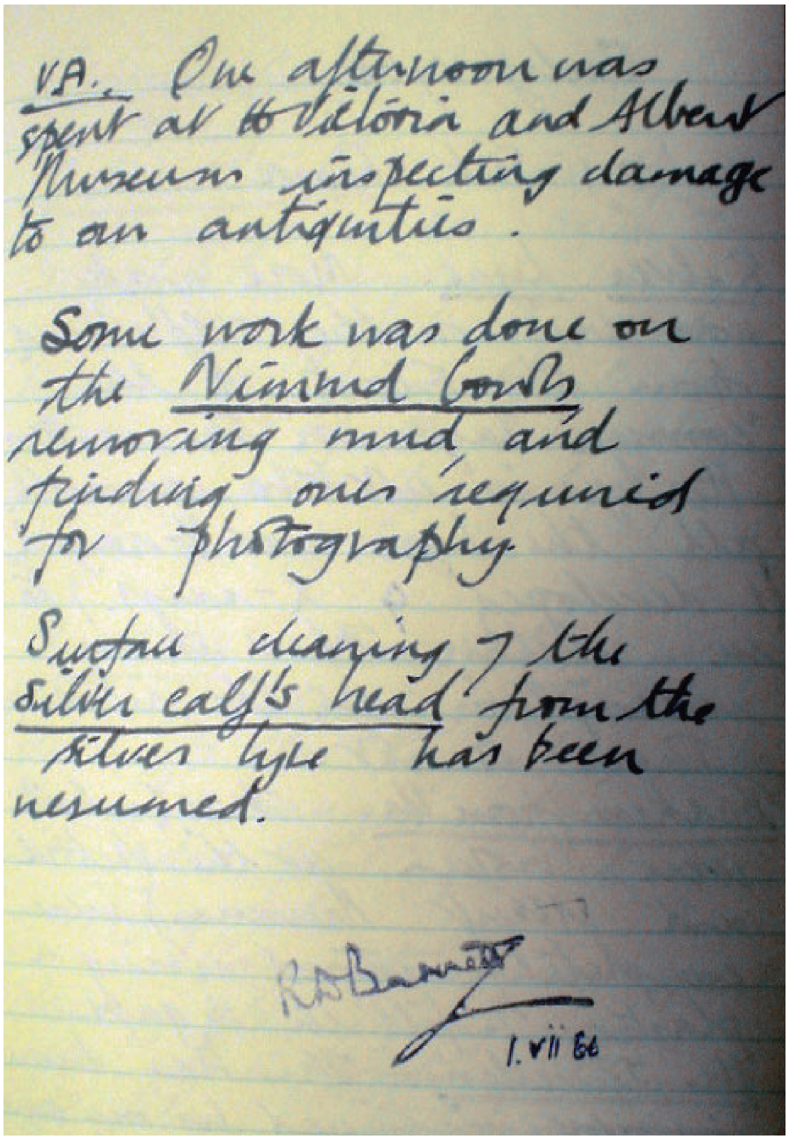
(9). Brush with a glass-bristle brush. The outer corrosion layer is often rather loose, so the brushing must be gentle. Sometimes it is possible to seal down the edges of the upper layer with a little Tensol before brushing.

(10). Bend silver to shape. (Method described on another sheet).

Modifications in Treatment.

The shape of certain pieces of $AgCl$ from the lyre makes it difficult to reach the back of the fragments. (i.e. the tuning rods) Tensol is poured into the interior as usual, but the tinned copper wires are laid along the outer surface & covered with a thin strip of ash-toughened wax, heat-sealed at the edges. Reduction then proceeds as normal, though it is advisable to move the location of the wires after a week or so. Occasionally when reduction is completed the silver becomes covered with a pink film (copper from the wires probably). This disappears in the air or else washes off. It can however be mistaken for $AgCl$ while the silver is still in the Tank.

Figure 103. R.M. Organ's notes on consolidative silver reduction, continued.



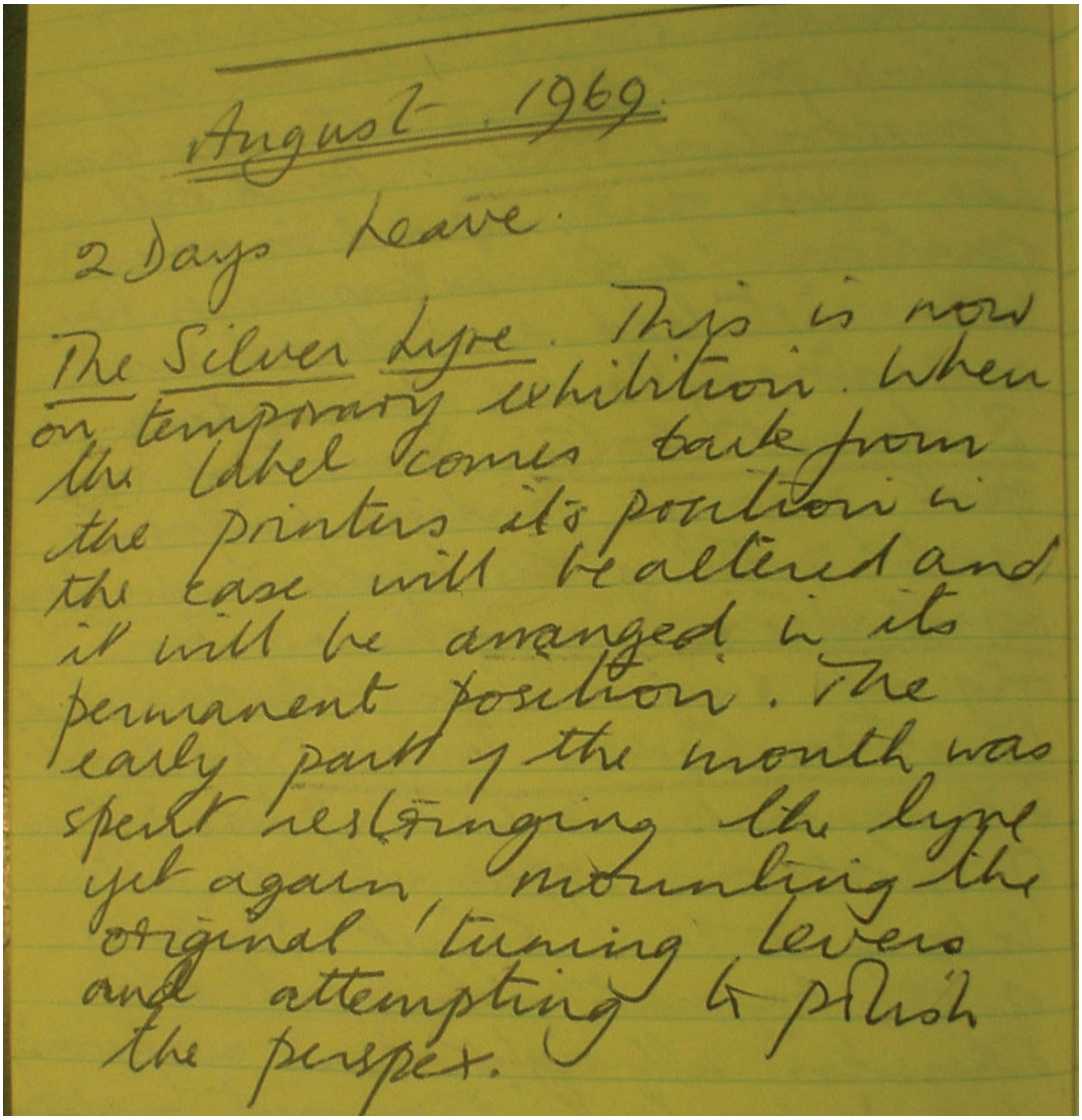
V.A. One afternoon was spent at the Victoria and Albert Museum inspecting damage to our antiquities.

Some work was done on the Nimrud bowls removing mud and finding ones required for photography

Surface cleaning of the silver calf's head from the silver lyre has been resumed.

R D Barnett
1. vii 66

Figure 104. Page of a diary for the first of August 1966 signed by Dr Richard Barnett who was Keeper of the Western Asiatic Department at the British Museum. Aside other works at the Victoria and Albert Museum and work on the Nimrud bowls, there was some surface cleaning of the calf's head of the silver lyre.



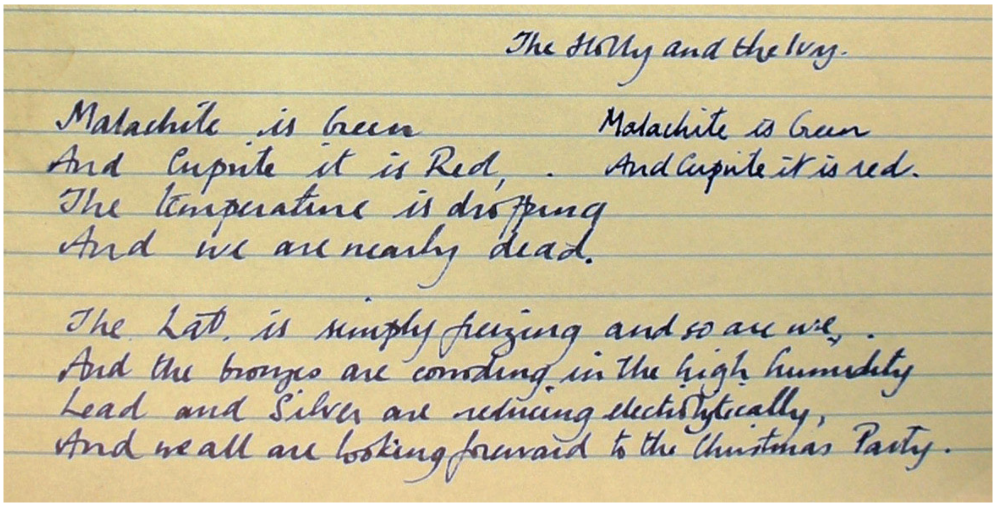
August 1969.

2 Days Leave.

The Silver Lyre. This is now on temporary exhibition. When the label comes back from the printers its position in the case will be altered and it will be arranged in its permanent position. The early part of the month was spent restringing the lyre yet again, mounting the original 'tuning levers and attempting to polish the perspex.

Figure 105. Facsimile of a conservation diary page for August 1969 saying that:

'The Silver Lyre. This is now on temporary exhibition. When the label comes back from the printers its position in the case will be altered and it will be arranged in its permanent position. The early part of the month was spent restringing the lyre yet again, mounting the original tuning levers and attempting to polish the perspex.'



The Holly and the Ivy.

Malachite is Green — Malachite is Green
And Cuprite it is Red, . — And Cuprite it is red.
The temperature is dropping
And we are nearly dead.

The Lab. is simply freezing and so are we, .
And the bronzes are corroding in the high humidity
Lead and Silver are reducing electrolytically,
And we all are looking forward to the Christmas Party.

Figure 106. Preparing for the Christmas party with some frustration about the restoration of the lyre:

Malachite is green
And Cuprite it is red,
The temperature is dropping
And we are nearly dead.

The lab. is simply freezing and so are we.
And the bronzes are corroding in the high humidity
Lead and silver are reducing electrolytically,
And we all are looking forward to the Christmas Party.



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